P2219,1907

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AN ABSOLUTELY UNEQUALLED SELECTION
FOR EVERY DEPARTMENT OF PHOTOGRAPHY.

Index to Text, pages 1131 to 1138.
Index to Advertisements, pages 1231 to 1233.

1907.

JANUARY.

S	M	T	W	T	F	S
...	...	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
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FEBRUARY

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MARCH.

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APRIL.

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MAY.

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JUNE.

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JULY.

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AUGUST.

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SEPTEMBER.

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OCTOBER.

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NOVEMBER.

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DECEMBER.

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29	30	31	...	...	...	...

Postal and Telegraphic Addresses, pages 1243 to 1256.

ROSS'
PATENT 'HOMOCENTRIC' LENSES.

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JANUARY.

D M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. H. M.	MOON. Sets. H. M.
1	Tu		8 9	3 58	5a49	9m0
2	W		8 8	3 59	6 52	9 43
3	Th		8 8	4 0	7 58	10 15
4	F	First R.P.S. Exhibition, 1854	8 8	4 1	9 7	10 41
5	S		8 8	4 2	10 16	11 6
6	S	Epiphany	8 8	4 3	11 28	11 27
7	M	(2.48 A.	8 7	4 4	Morn	11 51
8	Tu		8 7	4 6	0 43	0a14
9	W		8 6	4 7	1 59	0 39
10	Th	German Copyright Act, 1876	8 6	4 9	3 20	1 9
11	F		8 5	4 10	4 40	1 47
12	S		8 5	4 11	5 58	2 34
13	S	1st Sunday after Epiphany	8 4	4 13	7 9	3 33
14	M	Prof. Ernst Abbè d. 1905 ● 5.57 M.	8 3	4 14	8 9	4 43
15	Tu		8 3	4 16	8 56	6 1
16	W	Washed Emulsion, Bolton, 1874	8 2	4 17	9 34	7 19
17	Th		8 1	4 19	10 4	8 37
18	F	Finder invented (Taupenot) 1856	8 0	4 21	10 30	9 50
19	S	Henri Boissonnas d. 1889	7 59	4 22	10 51	11 2
20	S	2nd Sunday after Epiphany	7 58	4 24	11 12	Morn
21	M	) 8.42 M.	7 57	4 25	11 34	0 10
22	Tu		7 56	4 27	11 55	1 17
23	W		7 55	4 29	0a21	2 22
24	Th		7 54	4 31	0 48	3 26
25	F	Talbot's Prints first shown, 1839	7 52	4 32	1 21	4 27
26	S		7 51	4 34	2 0	5 25
27	S	Septuagesima Sunday	7 50	4 36	2 48	6 17
28	M	Photo-sculpture pat. by Willème	7 48	4 38	3 41	7 3
29	Tu	[1863 ○ 1.45 A.	7 47	4 39	4 43	7 44
30	W	[Royal Soc. 1839	7 46	4 41	5 48	8 17
31	Th	Fox Talbot's first communication to	7 44	4 43	6 57	8 46

Historical notes on many of the above items appear in each issue of THE BRITISH JOURNAL OF PHOTOGRAPHY for 1905.

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FEBRUARY.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises H. M.	MOON. Sets. H. M.
1	F		7 43	4 45	8a 8	9m11
2	S		7 41	4 47	9 19	9 34
3	S	Sexagesima Sunday. J. R. John-	7 40	4 48	10 34	9 55
4	M	[son's carbon pat., 1869	7 38	4 50	11 46	10 18
5	Tu		7 36	4 52	Morn	10 42
6	W	Print made by Talbot, 1836 (0.52 M.	7 35	4 54	1 6	11 10
7	Th		7 33	4 56	2 23	11 42
8	F	Calotype Process pat., 1841	7 30	4 57	3 36	0a36
9	S	[Brewster d. 1868	7 30	5 0	4 50	1 15
10	S	Quinquagesima Sunday. Sir David	7 28	5 1	5 54	2 18
11	M	Fox Talbot b. 1800	7 26	5 3	6 54	3 31
12	Tu	● 5.43 A.	7 24	5 5	7 27	4 48
13	W		7 22	5 7	8 1	6 6
14	Th		7 20	5 8	8 29	7 25
15	F		7 19	5 10	8 52	8 40
16	S		7 17	5 12	9 13	9 51
17	S	1st Sunday in Lent	7 15	5 14	9 37	11 0
18	M		7 13	5 16	9 58	Morn
19	Tu	[at Royal Soc., 1840	7 11	5 18	10 21	0 7
20	W	Sir John Herschel's paper) 4.35 A.	7 9	5 19	10 48	1 12
21	Th	Talbot's paper at Royal Soc., 1839	7 7	5 21	11 17	2 16
22	F		7 5	5 23	11 56	3 15
23	S		7 3	5 25	0a41	4 9
24	S	2nd Sunday in Lent	7 1	5 27	1 33	4 58
25	M		6 58	5 28	2 32	5 40
26	Tu		6 56	5 30	3 35	6 16
27	W		6 54	5 32	4 45	6 46
28	Th	○ 8.23 M.	6 52	5 34	5 56	7 14

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THE

Wratten Non-Colour Sensitive

PLATES

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MARCH.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. H. M.	MOON. Sets. H. M.
1	F		6 50	5 36	7 a 9	7m37
2	S	Dr. Hurter d. 1898	6 48	5 37	8 23	8 0
3	S	3rd Sunday in Lent	6 46	5 39	9 37	8 23
4	M	Poitevin d. 1882	6 43	5 41	10 54	8 46
5	Tu	J. Albert b. 1825	6 41	5 43	Morn	9 12
6	W		6 39	5 44	0 12	9 43
7	Th	J. N. Niepce b. 1765. ☾ 8.42 M.	6 37	5 46	1 27	10 52
8	F		6 35	5 48	2 38	11 8
9	S	J. B. Reade's process, 1839	6 32	5 50	3 44	0a 5
10	S	4th Sunday in Lent	6 30	5 51	4 42	1 13
11	M		6 28	5 53	5 23	2 26
12	Tu		6 26	5 55	6 0	3 43
13	W	[Scc., 1839	6 23	5 56	6 29	5 0
14	Th	Herschel's process Royal ☾ 6.5 M.	6 21	5 58	6 53	6 17
15	F	Dr. Hurter b. 1844	6 19	6 0	7 15	7 30
16	S	Collodio Chl. G. W. Simpson, 1865	6 17	6 2	7 38	8 40
17	S	5th Sunday in Lent.	6 14	6 3	8 0	9 50
18	M		6 12	6 5	8 23	10 57
19	Tu	Thomas Sutton d. 1875	6 10	6 7	8 47	Morn
20	W		6 8	6 8	9 16	0 3
21	Th		6 5	6 10	9 50	1 5
22	F	Liverpool P.S. founded 1853 ☽ 1.10M.	6 3	6 12	10 33	2 3
23	S		6 1	6 13	11 22	2 52
24	S	Palm Sunday Becquerel b. 1820	5 58	6 15	0a16	3 36
25	M		5 56	6 17	1 20	4 14
26	Tu		5 54	6 19	2 26	4 47
27	W	John Pouncey d. 1894	5 51	6 20	3 37	5 14
28	Th	[1878	5 49	6 22	4 50	5 38
29	F	Bennett's emulsion process, ○ 7.44 A	5 47	6 24	6 4	6 3
30	S		5 45	6 25	7 20	6 25
31	S	Easter Sunday	5 42	6 27	8 40	6 49

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1906 ISSUE OF

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APRIL.

D. M.	D. W.	Remarkable Events.		SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. H. M.	MOON. Sets. H. M.
1	M			5 40	6 29	9a59	7m15
2	Tu			5 37	6 30	11 18	7 45
3	W			5 35	6 32	Morn	8 20
4	Th			5 33	6 34	0 33	9 3
5	F	Rev. J. B. Reade b. 1801	☾ 3.21 A.	5 30	3 35	1 41	9 58
6	S			5 28	6 37	2 38	11 1
7	S	1st Sunday after Easter. Voigt'ander		5 26	6 39	3 23	0a14
8	M	[d. 1878		5 24	6 41	4 1	1 27
9	Tu			5 22	6 42	4 30	2 43
10	W	Gum Bichromate pat. 1858		5 19	6 44	4 56	3 59
11	Th	Willis Aniline process 1865		5 17	6 45	5 19	5 11
12	F	Steinheil b. 1832	● 7.6 A.	5 15	6 47	5 40	6 23
13	S			5 13	6 49	6 2	7 33
14	S	2nd Sunday after Easter.		5 10	6 50	6 23	8 41
15	M			5 8	6 52	6 47	9 49
16	Tu			5 6	6 54	7 14	10 53
17	W			5 4	6 55	7 46	11 52
18	Th	Ponton's Bichromate process, 1839		5 2	6 57	8 25	Morn
19	F	Warren de la Rue d. 1889		5 0	6 59	9 11	0 45
20	S		☽ 8.38 A.	4 58	7 0	10 3	1 33
21	S	3rd Sunday after Easter		4 55	7 2	11 1	2 13
22	M			4 53	7 4	0a 6	2 48
23	Tu			4 51	7 5	1 15	3 15
24	W			4 49	7 7	2 27	3 42
25	Th	Dr. Miethe b. 1862		4 47	7 9	3 40	4 4
26	F	Adam Salomon d. 1881		4 45	7 10	3 56	4 27
27	S			4 43	7 12	5 13	4 51
28	S	4th Sunday after Easter	○ 6.5 M.	4 41	7 14	7 36	5 14
29	M			4 39	7 15	8 58	5 42
30	Tu	Col. Stuart Wortley d. 1890		4 37	7 17	10 18	6 17

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COLOUR SENSITIVE PLATES

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COLOUR ✻ SENSITIVENESS.

MAY.

D. M.	D. W.	Remarkable Events.		SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. H. M.	MOON. Sets. H. M.
1	W			4 36	7 19	11a33	6m57
2	Th			4 34	7 20	Morn	7 49
3	F			4 32	7 22	0 36	8 52
4	S		(9.54 A.	4 30	7 23	1 26	10 3
5	S	Rogation Sunday.	J. W. Draper	4 28	7 25	2 5	11 16
6	M	Humbo'dt d. 1859	[b. 1811	4 26	7 27	2 37	Aft
7	Tu			4 25	7 28	3 3	1 47
8	W	P. Meagher d. 1897		4 23	7 30	3 27	3 0
9	Th			4 21	7 31	3 48	4 10
10	F	South London Photo Soc. f. 1859		4 19	7 33	4 7	5 20
11	S	R. L. Maddox d. 1902		4 18	7 35	4 28	6 29
12	S	Sunday after Ascension	● 8.59 A.	4 16	7 36	4 51	7 37
13	M	Dr. P. H. Emerson b. 1856.		4 15	7 38	5 15	8 43
14	Tu	Fahrenheit b. 1686		4 13	7 39	5 45	9 44
15	W			4 11	7 40	6 22	10 38
16	Th	Major C. Russell d. 1887		4 10	7 42	7 4	11 30
17	F			4 9	7 44	7 53	Morn
18	S			4 7	7 45	8 49	0 12
19	S	Whit Sunday		4 6	7 47	9 51	0 48
20	M		) 1.28 A.	4 4	7 48	10 57	1 20
21	Tu	Schee'e d. 1776		4 3	7 49	0a 6	1 44
22	W			4 2	7 51	1 17	2 8
23	Th	B. J. Sayce d. 1895		4 1	7 52	2 30	2 30
24	F			3 59	7 54	3 46	2 53
25	S		[d. 1890	3 58	7 55	5 6	3 15
26	S	Trinity Sunday	H. B. Berkeley	3 57	7 56	6 30	3 59
27	M		○ 2.18 A.	3 56	7 57	7 52	4 10
28	Tu			3 55	7 59	9 12	4 49
29	W			3 54	8 0	10 24	5 36
30	Th			3 53	8 1	11 22	6 36
31	F			3 52	8 2	Morn	7 46

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JUNE.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. H. M.	MOON. Sets. H. M.
1	S	Talbot's patents, 1841	3 51	8 3	0m 6	9m 3
2	S	1st Sunday after Trinity.	3 50	8 6	0 42	10 19
3	M	☾ 5.20 M.	3 50	8 7	1 9	11 36
4	Tu		3 49	8 8	1 33	0a50
5	W	First Platinotype patent, 1873	3 48	8 9	1 54	2 1
6	Th		3 48	8 10	2 13	3 11
7	F		3 47	8 10	2 34	4 19
8	S	[d. 1897	3 46	8 11	2 56	5 26
9	S	2nd Sun. aft. Trin. Alvan Clark	3 46	8 12	3 19	6 33
10	M	Talbot on Calotype at ● 11.50 A.	3 45	8 13	3 47	7 37
11	Tu	[the Royal Society, 1841	3 45	8 14	4 20	8 34
12	W		3 45	8 14	5 1	9 27
13	Th		3 44	8 15	5 47	10 12
14	F	Daguerre received pension, 1839	3 44	8 16	6 42	10 51
15	S	Bertsch's fixed focus camera, 1860	3 44	8 16	7 40	11 23
16	S	3rd Sunday after Trinity.	3 44	8 17	8 45	11 48
17	M		3 44	8 17	9 53	Morn
18	Tu	[1874	3 44	8 17	10 1	0 12
19	W	Kennet emulsion marketed, ☽ 2.55 M.	3 44	8 18	0a11	0 34
20	Th		3 44	8 18	1 24	0 56
21	F	Waterhouse stop introduced, 1858	3 44	8 18	2 39	1 17
22	S	Sir J. W. Swan's brom. paper pat.	3 45	8 18	3 59	1 40
23	S	4th Sun. aft. Trin. E. L. Wilson	3 45	8 19	5 22	2 6
24	M	Hardwich d. 1890 [d. 1903	3 45	8 19	6 43	2 40
25	Tu	○ 9.27 A.	3 45	8 19	8 0	3 21
26	W	Liesegang b. 1839	3 46	8 19	9 6	4 16
27	Th	Wothley d. 1873	3 46	8 19	9 59	5 23
28	F	[pub. 1877	3 47	8 19	10 40	6 40
29	S	Ferrous-oxalate Developer	3 47	8 19	11 12	7 58
30	S	5th Sun. aft. Trin. Marten's Pano- [ramic Camera, 1845	3 48	8 19	11 38	9 18

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JULY.

D. M.	D. W.	Remarkable Events.		SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. H. M.	MOON. Sets. H. M.
1	M	Copyright Act passed, 1862		3 48	8 18	12a 0	10m36
2	Tu		(2.34 A.	3 49	8 18	Morn	11 50
3	W			3 50	8 18	0 20	1a 0
4	Th			3 50	8 17	0 41	2 10
5	F	Nicephore Niepce d. 1833		3 51	8 17	1 2	3 17
6	S	W. J. Stillman d. 1901		3 52	8 16	1 25	4 24
7	S	6th Sunday after Trinity		3 53	8 16	1 50	5 29
8	M			3 54	8 15	2 22	6 29
9	Tu			3 55	8 15	2 59	7 23
10	W	Daguerre d. 1851	● 3.17 A.	3 56	8 14	3 44	8 11
11	Th			3 57	8 13	4 35	8 52
12	F	Second platinotype patent, 1878		3 58	8 13	5 34	9 27
13	S			3 59	8 12	6 36	9 54
14	S	7th Sunday after Trinity.		4 0	8 11	7 44	10 18
15	M			4 1	8 10	8 51	10 40
16	Tu			4 2	8 9	9 51	11 0
17	W	[advt. 1873		4 3	8 8	11 12	11 21
18	Th	Gelatine emulsion first	) 1.12 A.	4 4	8 7	Aft.	11 42
19	F	The Copyright Union founded 1893		4 6	8 6	1 36	Morn
20	S	Collodion Pos. Process pub. 1852		4 7	8 5	2 56	0 5
21	S	8th Sunday after Trinity.		4 8	8 4	4 15	0 36
22	M			4 10	8 2	5 34	1 14
23	Tu	[General Waterhouse b. 1842		4 11	8 1	6 45	1 58
24	W	Sir William Abney b. 1843. Major-		4 12	8 0	7 44	2 57
25	Th		○ 4.30 M.	4 14	7 59	8 35	4 10
26	F	Niepce de St. Victor b. 1806		4 15	7 57	9 9	5 33
27	S			4 16	7 56	9 39	6 52
28	S	9th Sunday after Trinity.		4 18	7 54	10 3	8 13
29	M			4 19	7 53	10 25	9 32
30	T			4 21	7 52	10 46	10 46
31	W			4 22	7 50	11a 7	11m57

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AUGUST.

D. M.	D. W.	Remarkable Events.	Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. H. M.	Moon. Sets. H. M.
1	Th	(2.25 M.	4 24	7 48	11a30	1 a 7
2	F		4 25	7 47	11 54	2 15
3	S	Mungo Ponton d. 1880	4 27	7 45	Morn	3 21
4	S	10th Sunday after Trinity	4 28	7 44	0 23	4 22
5	M	W. K. Burton d. 1899	4 30	7 42	0 59	5 18
6	Tu		4 31	7 40	1 41	6 9
7	W	[b. 1857	4 33	7 38	2 30	6 51
8	Th	Roger Fenton d. 1869. Ed. Valenta	4 34	7 37	3 26	7 28
9	F	● 6.36 M.	4 36	7 35	4 29	7 58
10	S	W. H. Harrison d. 1897.	4 38	7 33	5 35	8 22
11	S	11th Sunday after Trinity	4 39	7 31	6 43	8 46
12	M		4 41	7 29	7 50	9 6
13	Tu	Sir G. G. Stokes b. 1819, d. Feb. 8,	4 42	7 27	9 1	9 26
14	W	Daguerre's Eng. pat. 1839 [1903	4 44	7 25	10 12	9 48
15	Th		4 45	7 23	11 25	10 10
16	F	Lavoisier b. 1743) 9.6 A.	4 47	7 21	0a10	10 35
17	S		4 49	7 19	1 57	11 7
18	S	12th Sunday after Trinity	4 50	7 17	3 14	11 48
19	M		4 52	7 16	4 26	Morn
20	Tu	Daguerreotype pub. 1839	4 53	7 14	5 29	0 40
21	W	Chevreul b. 1786	4 55	7 12	6 21	1 45
22	Th		4 57	7 9	7 3	3 0
23	F	○ 0.15 A.	4 58	7 7	7 36	4 20
24	S	Scott-Archer collodion pat. 1855	5 0	7 5	8 3	5 44
25	S	13th Sun. aft. Trin. Faraday d.	5 1	7 3	8 26	7 6
26	M	Daguerre Mem. uncov. 1883 [1867	5 3	7 1	8 47	8 23
27	Tu		5 5	6 59	9 8	9 39
28	W		5 6	6 57	9 31	10 51
29	Th		5 8	6 54	9 54	0 a 2
30	F	Oliver Sarony died 1879 (5.23 A.	5 9	6 52	10 23	1 10
31	S		5 11	6 50	10 57	2 13

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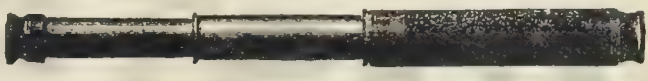
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SEPTEMBER.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. H. M.	MOON. Sets. H. M.
1	S	14th Sunday after Trinity	5 12	6 48	11a36	3a11
2	M		5 14	6 46	Morn	4 4
3	Tu		5 16	6 43	0 24	4 49
4	W		5 17	6 41	1 18	5 29
5	Th	W. B. Woodbury d. 1885	5 19	6 39	2 17	6 0
6	F		5 20	6 37	3 20	6 26
7	S	Poitevin Mem. inaug., 1885 ● 9.4 A.	5 22	6 34	4 31	6 50
8	S	15th Sunday after Trinity	5 24	6 32	5 41	7 11
9	M	Col.-bro. Proc. pub. 1864.	5 25	6 30	6 51	7 33
10	Tu		5 27	6 28	8 2	7 54
11	W		5 28	6 25	9 16	8 14
12	Th		5 30	6 23	10 32	8 38
13	F		5 32	6 21	11 48	9 8
14	S		5 33	6 18	1a 2	9 45
15	S	16th Sunday after Trinity. ☽ 3.4 M.	5 35	6 16	2 16	10 31
16	M	Panoramic lens (Sutton) p. 1861	5 36	6 14	3 21	11 29
17	Tu	Fox Talbot d. 1877	5 38	6 12	4 15	Morn
18	W	Leon Foucault b. 1819	5 40	6 9	4 58	0 39
19	Th	T. Grubb d. 1878	5 41	6 7	5 35	1 57
20	F	Talbot Discovers Development 1840	5 43	6 5	6 3	3 17
21	S	Stas b. 1813 ○ 9.34 A.	5 44	6 2	6 27	4 39
22	S	17th Sunday after Trinity	5 46	6 0	6 48	5 58
23	M	Woodbury type pat. 1864	5 48	5 58	7 10	7 16
24	Tu	[b. 1834, d. 1882	5 49	5 55	7 31	8 31
25	W	Dr. Van Monckhoven	5 51	5 53	7 56	9 43
26	Th		5 53	5 51	8 21	10 55
27	F		5 54	5 48	8 53	Morn
28	S		5 56	5 46	9 30	1a 2
29	S	18th Sunday after Trinity ☾ 11.37 M	5 57	5 54	10 15	1 57
30	M		5 59	5 42	11 6	2 46

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OCTOBER.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. H. M.	MOON. Sets. H. M.
1	Tu		6 1	5 39	Morn	3a28
2	W		6 2	5 37	0 4	4 2
3	Th		6 4	5 35	1 9	4 29
4	F		6 6	5 33	2 15	4 54
5	S	Louis Lumière b. 1864	6 7	5 30	3 24	5 16
6	S	19th Sunday after Trinity	6 9	5 28	4 36	5 36
7	M	Leon Warnerke d. 1900 ● 10.21 M.	6 11	5 26	5 48	5 57
8	Tu		6 12	5 23	7 3	6 19
9	W		6 14	5 21	8 19	6 41
10	Th		6 16	5 19	9 36	7 10
11	F		6 17	5 17	10 54	7 44
12	S		6 19	5 15	0a 9	8 27
13	S	20th Sunday after Trinity	6 21	5 12	1 16	9 21
14	M	J. J. Elliot b. 1835. ☽ 10.2 M.	6 22	5 10	2 14	10 27
15	Tu	[d. March 30, 1903	6 24	5 8	2 59	11 41
16	W		6 26	5 6	3 37	Morn
17	Th	Dr. Neuhauss b. 1855	6 27	5 4	4 5	0 58
18	F	Wheatstone d. 1875	6 29	5 2	4 30	2 17
19	S	Aug. Lumière b. 1862	6 31	5 0	4 51	3 36
20	S	21st Sunday after Trinity	6 33	4 57	5 12	4 54
21	M	○ 9.17 M.	6 34	4 55	5 34	6 9
22	Tu		6 36	4 53	5 53	7 23
23	W		6 38	4 51	6 20	8 35
24	Th		6 40	4 49	6 50	9 45
25	F	Vernon Heath d. 1895	6 41	4 47	7 25	10 50
26	S		6 43	4 45	8 6	11 49
27	S	22nd Sunday after Trinity	6 45	4 43	8 55	0a40
28	M	Col.-chlo. of Silver Process pub. 1864	6 47	4 41	9 50	1 25
29	Tu	Talbot Photo-eng. Process ☾ 7.52 M.	6 49	4 39	10 53	2 3
30	W	[pat. 1852	6 50	4 37	11 58	2 33
31	Th		6 52	4 35	Morn	2 56

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NOVEMBER.

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1	F		6 54	4 34	1 m5	3a20
2	S		6 56	4 32	2 15	3 40
3	S	23rd Sunday after Trinity	6 57	4 30	3 25	4 0
4	M	Statue to Daguerre at Bry, 1852	6 59	4 28	4 39	4 20
5	Tu	● 10.39 A.	7 1	4 26	5 57	4 43
6	W	Senefelder b. 1771	7 3	4 25	7 15	5 9
7	Th	Col. C. G. H. Kinnear d. 1894	7 5	4 23	8 37	5 43
8	F	J. Traill Taylor d. 1895	7 6	4 21	9 6	6 22
9	S	Pretsch's Pho.-eng. pro. pat. 1854	7 8	4 20	11 10	7 14
10	S	24th Sunday after Trinity Ortho-	7 10	4 18	0a12	8 17
11	M	[chromatism, Vogel 1873	7 12	4 16	1 2	9 30
12	Tu	☽ 5.14 A.	7 13	4 15	1 40	10 47
13	W	Sir H. Trueman Wood b. 1845	7 15	4 13	2 11	Morn
14	Th		7 17	4 12	2 35	0 6
15	F		7 19	4 11	2 58	1 23
16	S		7 20	4 9	3 19	2 39
17	S	25th Sunday after Trinity	7 22	4 8	3 39	3 54
18	M	Daguerre b. 1787	7 24	4 6	3 59	5 6
19	Tu		7 25	4 5	4 22	6 18
20	W	Kennett's Pellicle pat. 1873 ○ 0.4 M.	7 27	4 4	4 48	7 30
21	Th		7 29	4 3	5 20	8 37
22	F	Schlippe b. 1749	7 30	4 2	5 59	9 39
23	S	Harrison (Inv. of Globe Lens),	7 32	4 1	6 45	10 35
24	S	26th Sunday after Trinity [d. 1864	7 34	3 59	7 39	11 22
25	M		7 35	3 58	8 39	0 a 2
26	Tu		7 37	3 57	9 42	0 34
27	W	[Camera pat. 1859.	7 39	3 56	10 48	1 1
28	Th	Sutton's Panoramic ☾ 4.21 M.	7 40	3 55	11 55	1 24
29	F		7 42	3 55	Morn	1 45
30	S		7 43	3 54	1 5	2 5

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DECEMBER.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. H. M.	MOON. Sets. H. M.
1	S	1st Sun. in Advent. Carl Zeiss d.	7 43	3 53	2m15	2a25
2	M	[1888	7 46	3 53	3 30	2 45
3	Tu		7 47	3 52	4 48	3 8
4	W	R. Kennett d. 1896	7 49	3 51	6 9	3 37
5	Th	Obernetter's chromo-photo pat. 1864	7 50	3 51	7 30	4 14
6	F	[● 10.22 M.	7 51	3 50	8 50	5 1
7	S		7 52	3 50	10 0	6 0
8	S	2nd Sun. in Advent.	7 53	3 50	10 58	7 13
9	M		7 55	3 49	11 41	8 32
10	Tu		7 56	3 49	0a16	9 52
11	W	Sir D. Brewster b. 1781	7 57	3 49	0 42	11 12
12	Th	Rev. J. B. Reade d. 1870 ☽ 2.16 M.	7 58	3 49	1 4	Morn
13	F	Poitevin's Photo.-eng. pat. 1855	7 59	3 49	1 26	0 29
14	S	Niepce-Daguerre Partnership 1837	8 0	3 49	1 46	1 43
15	S	3rd Sun. in Advent. [1870.	8 1	3 49	2 6	2 55
16	M	H. Greenwood d. 1884. T. Ross d.	8 2	3 49	2 27	4 6
17	Tu	Claudet's Art Light pat. 1841	8 3	3 49	2 51	5 18
18	W		8 4	3 49	3 20	6 26
19	Th	Dr. H. W. Vogel d. 1898 ○ 5.55 A.	8 4	3 50	3 57	7 29
20	F		8 5	3 50	4 39	8 29
21	S		8 6	3 50	5 30	9 19
22	S	4th Sun. in Advent. Wollaston d.	8 7	3 50	6 27	10 3
23	M	[1828	8 7	3 51	7 30	10 36
24	Tu		8 8	3 52	8 34	11 6
25	W	Christmas Day. Sir I. Newton	8 8	3 53	9 40	11 29
26	Th	[b. 1642	8 8	3 53	10 46	11 51
27	F	☾ 11.11 A.	8 8	3 54	11 56	0a11
28	S	J. T. Goddard d. 1866	8 8	3 55	Morn	0 29
29	S	1st Sun. after Christmas.	8 9	3 56	1 6	0 47
30	M	J. H. Dallmeyer d. 1883	8 9	3 57	2 18	1 9
31	Tu	A. Braun 1877.	8 9	3 58	3 37	1 33

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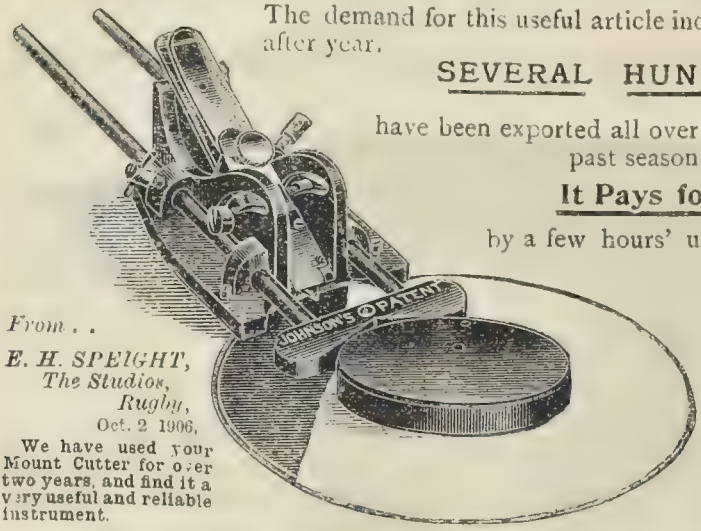
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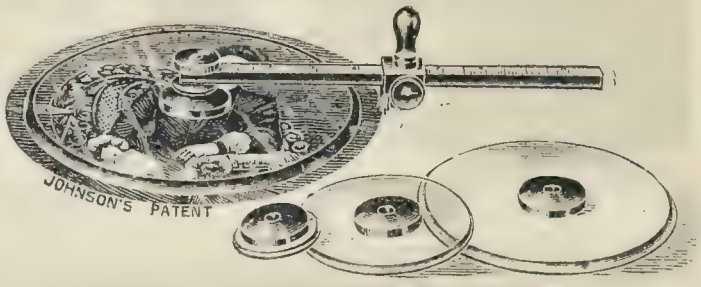
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INDEX

	Page
General Terms to Photographers	4
Note respecting Enlargements	5
Bromide Enlargements on Paper—Single Copies, Quantities	6
,, ,, Oval and Circular	7
,, ,, on Opal and Canvas	8
,, Contacts - Large and Small Quantities	9
Carbon Enlargements on Paper and Mounting	10
,, ,, on Opal and Direct Printing	11
,, ,, on Canvas	12
,, on Ivory	12
Platinotype Enlargements	12
Finishing in Monochrome	13
,, in Semi-Tint	14
Oil and Water Colours for Carbon	14
Miniature Painting on Ivory	14
Oil and Water Colours for Bromide	15
Finishing in Crayons	15
Painting in Oil—Carbon and Bromide on Canvas	16
Making Negatives, Registration and Purchase, and Lantern Slides	17
Developing, etc	18
Silver, P.O.P. and Platinotype Printing	19
Carbon Specialities	20
Bromide Specialities	21
Remarks *re* Post Cards	22
Real Plate Paper Mounts	23
Barnet Plates	24
,, Bromide Papers	25
,, P.O.P.	26
,, Carbon Tissue	27
,, Roll Film and Lantern Plate	28
,, Post Cards	22

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PHOTOGRAPHIC SOCIETIES.

PHOTOGRAPHIC SOCIETIES OF THE UNITED KINGDOM.

The following list of British Photographic Societies has been compiled from data supplied by their respective Secretaries, except where so indicated. In these instances no information has been received up to the time of going to press.

* Societies marked with an asterisk are affiliated to the Royal Photographic Society.

*The Royal Photographic Society of Great Britain.

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Secretary.—J. McIntosh, 66, Russell Square, London.

Aberdeen Photo Art Club.—*Pres.*, G. L. Smith. *Meetings*, 62, Fonthill Road, Friday, 7.30 p.m. *Sec.*, Mr. John Rae, 19, St. Nicholas Street, Aberdeen.

Aberdeen Photographic Association.—*Pres.*, James S. Anderson. *Meetings*, 154, Union Street, Friday, 8 p.m. *Sec.*, Andrew Gray, 18, South Mount Street.

Aberystwyth Photographic Society. — *Particulars not received from Secretary.*

Accrington Camera Club. — *Pres.*, Dr. Frankish. *Meetings*, Mechanics' Institute. *Sec.*, John B. Holt, 79, Church Street, Church, Lancs.

***Acton and Chiswick Polytechnic Photographic Club.**—*Pres.*, V. C. Egerton. *Meetings*, Polytechnic, Bath Road, Bedford Park, W., Monthly, Tuesdays. *Sec.*, A. G. Field, 66, Russell Square, W.C.

Acton Photographic Society —*Pres.*, Percy Lawrence. *Meetings*, October to March, Second and Fourth Wednesdays; April to September, Second Wednesday. *Sec.*, Eugene Todd, Camden Villa, Churchfield Road, East Acton, W.

Airdrie (Monklands), N.B.—*Pres.*, John McGovern. *Meetings*, Victoria Place, Tuesdays, October to April, weekly. *Sec.*, Jos. Higginson, Graham Street, Airdrie.

***Aldershot and District Camera Club.**—*Pres.*, A. H. Smith. *Meetings*, Masonic Hall, in summer First and Third Wednesdays, winter First and Third Mondays. *Ex.*, March. *Sec.*, D. Morrison, York Crescent, York Road, Aldershot.

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Altrincham Photographic Society.—*Pres.*, D. S. Morrison. *Meetings*, 7, Market Street, Altrincham, First and Third Tuesdays in month, *Ex.*, February, 1907. *Sec.*, H. E. Barwell, 5, Hawthorn Road, Altrincham.

Amateur Photographic Field Club.—*Pres.*, Viscount Maitland. *Sec*, Basil E. Lawrence, LL.D., 12, Strathray Gardens, South Hampstead, London, N.W.

Arbroath Amateur Photographic Society.—*Pres.*, George G. Dalgarno. *Meetings*, Y.M.C.A. Rooms. *Sec.*, James Hood, 94, High Street, Arbroath.

***Architectural Association Camera and Cycling Club.**—*Pres.*, Gilbert H. Lovegrove. *Meetings*, 18, Tufton Street, Westminster, S.W., monthly in winter on Tuesdays, at 7.30 p.m. *Sec.*, Francis R. Taylor, 34, Hawarden Grove, Herne Hill, S.E.

***Artists' R.V.** (20th Middlesex).—*Pres.*, Colonel W. Horsley, V.D. *Meetings*, Duke's Road, Euston Road. *Sec.*, Henry W. Fairholme, Blenheim Mansions, Queen Anne's Gate, S.W.

***Ashton-under-Lyne Photographic Society.**—*Pres.*, Dr. Alex. Hamilton. *Meetings*, The Rooms, Henry Square, Ashton-under-Lyne. *Sec.*, Wm. Hallam, Ingleside, Taunton Road, Ashton-under-Lyne.

Aston Photographic Society.—*Pres.*, Harold Baker. *Meetings*, Burlington Hall, High Street, Aston, Thursdays, 8 p.m. (except June to September). *Sec.*, J. C. Taylor, 201, Albert Road, Aston.

Attercliffe Photographic Society.—*Pres.*, L. Havenhand. *Meetings*, The Friends' Meeting Rooms, Leeds Road, Sheffield, Second Monday in every month, 8 p.m. *Sec.*, George Walton, 57, Ditchingham Road, Sheffield.

***Balham Camera Club.**—*Pres.*, A. M. Partridge. *Meetings*, Masonic Hall, Chestnut Grove, Thursday, 8.30 p.m. *Sec.*, Sydney C. Wells, 8, Rusham Road, Balham, S.W.

Banbury and District Photographic Society.—*Particulars not received from Secretary.*

Barnstaple Y.M.C.A. Camera Club.—*Pres.*, G. M. Pitt. *Meetings*, Y.M.C.A., High Street, First Tuesday in the month, 8.15 p.m. *Secs.*, W. K. Massey, 16, Sticklepath, and A. Copp, Boutport Street, Barnstaple.

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Barrow Naturalists' Field Club (Photographic Section).—*Pres.*, J.W. Osborne. *Meetings*, Cambridge Hall, St. George's Square, alternate Tuesdays, 8.15 p.m. *Sec.*, James Frankland, 8, Greengate, Barrow.

Bath Y.M.C.A. Camera Club.—*Pres.*, Walter Pitt, C.E. *Meetings*, Y.M.C.A., alternate Thursdays. *Ex.*, April. *Secs.*, W. J. Hallett and F. Stone, 10, Stall Street, Bath.

Batley and District Photographic Society.—*Pres.*, W. Hemingway, M.A. *Meetings*, Technical School, Thursdays, fortnightly. *Sec.*, C. H. Giggal, Wellington Street, Batley.

Belfast Queen's College Camera Club.—*Pres.*, John Wylie, B.A. *Meetings*, Students' Union, Queen's College, Second Tuesday in month, at 7.45 p.m. *Sec.*, J. D. M. McCallum, Students' Union, Queen's College, Belfast.

***Belfast Y.M.C.A. Camera Club.**—*Pres.*, R. G. Moffet. *Meetings*, Y.M.C.A., Wellington Place, First Tuesday, September till April. *Sec.*, David James Hogg, 3, Trinity Street, Belfast.

***Belmont Camera Club.**—*Pres.*, C. Radburn. *Meetings*, Dark Room, Sherwood House, York Road, Battersea, S.W. *Sec.*, Godfrey C. Hellyer, Belmont Works, York Road, Battersea.

Bideford Camera Club.—*Pres.*, W. H. Thornton. *Meetings*, Bridge Buildings, alternate Wednesdays and Saturdays. *Sec.*, P. Bamberger, 8, Lime Grove, Bideford, North Devon.

***Birkenhead Photographic Association.**—*Pres.*, R. J. Russell. *Meetings*, Y.M.C.A., Grange Road, Fridays, 8 p.m., October to March. *Ex.*, January. *Sec.*, J. T. Peters, 62, Westbourne Road.

***Birmingham Photographic Society.**—*Pres.*, Howard J. Collins. *Meetings*, Norwich Union Chambers, Congreve Street, Tuesday (weekly winter, fortnightly summer). *Ex.*, February. *Sec.*, Lewis Lloyd, Norwich Union Chambers, Congreve Street.

Birstall Photographic Society.—*Pres.*, Albert Capstick. *Meetings*, Primitive Methodist Schoolroom, alternate Thursday evenings. *Sec.*, Wm. Blakeley, Chemist, Birstall.

***Bishop Auckland Photographic Society.**—*Pres.*, Sydney Foster. *Meetings*, Society's Rooms, Silver Street. *Ex.*, 6th, 7th and 8th November, 1906. *Sec.*, Geo. Ross, Cemetery Lodge.

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Blackburn and District Photographic Society.—*Pres.*, Richard Wolstenholme. *Meetings*, Society's Rooms and Dark Room, 6, Sudell Cross, Tuesdays and Thursdays, at 8 p.m. *Sec.*, Wilfrid Duxbury, 7, Queen's Place, Gawthorpe, Blackburn, Lancs.

***Blackburn Camera Club.**—*Pres.*, Dr. J. Barr. *Meetings*, 29, Church Street, every Third Monday from October 1st. *Sec.*, Frederick J. Gray, 110, Revidge Road, Blackburn.

Blairgowrie and District Photographic Association.—*Pres.*, Alexander Geekie. *Meetings*, George Street, Third Tuesday of month (except during June, July and August). *Sec.*, Lake Falconer, Jun., James Street Cottage, Blairgowrie.

Blyth and District Camera Club.—*Pres.*, A. D. Miller. *Meetings*, Christian's Meeting House, Wright Street, at 8 p.m. *Sec.*, W. French, 20, Barnard Street, Blyth.

Bolton Photographic Society.—*Sec.*, C. K. Dalton, 50, Higher Bridge Street, Bolton.

Bonnybridge Amateur Photographic Association.—*Pres.*, George Albert Ure. *Meetings*, Foundry Hall, Second Friday of each month, at 8 p.m. *Ex.*, Triennial (last held 1904). *Sec.*, Wm. Lapsley, Spencer Cottage, Bonnybridge.

Bootle Photographic Society.—*Pres.*, Ald. W. R. Brewster, J.P. *Meetings*, 324, Stanley Road, First and Third Tuesday, 8 p.m. *Ex.*, December. *Sec.*, W. E. Parry, 31, Browne Street, Bootle.

Bootle (St. Matthew's) Camera Club.—*Pres.*, Rev. W. Harry Roberts, M.A. *Meetings*, Parochial Hall, St. Matthew's Church, Thornton Road, Tuesday; Monthly during summer, Fortnightly during winter. *Ex.*, November. *Sec.*, Harold Tempest, 78, Thornton Road, Bootle, Liverpool.

***Borough Polytechnic Photographic Society.** — *Pres.*, A. Bedding. *Meetings*, Borough Polytechnic, 103, Boro' Road, S.E., Wednesdays in the Winter, First and Third Wednesdays in summer, 8.15 p.m. *Sec.*, W. F. Harrap, 103, Borough Road, S.E. London.

Boston Camera Club.—*Pres.*, Dr. C. W. Pilcher. *Meetings*, St. James' Schools, George Street, First and Third Tuesdays winter months, First Tuesday summer months. *Ex.*, January. *Sec.*, H. M. Hames, 65, West Street, Boston, Lincs.

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Bournemouth Y.M.C.A. Photographic Club.—*Pres.*, Rev. E. J. Kennedy. *Meetings*, Cairns Memorial House, Thursdays, 8 p.m. *Sec.*, A. D. Johnston, Cairns Memorial House, Bournemouth.

***Bowes Park and District Photographic Society.**—*Pres.*, A. J. Craston. *Meetings*, Unity Hall, Wood Green, First and Third Mondays. *Sec.*, Henry C. Bird, 91, Whittington Road, Bowes Park, N.

Bradford Photographic Society.—*Pres.*, G. A. Bever. *Meetings*, "Ye Mecca Cafe," Brook Street, Monday evenings, 8 p.m. *Sec.*, W. H. Womersley, 6, Spring Hurst Road, Shipley.

***Braintree and Bocking Camera Club.**—*Pres.*, E. B. Knobel. *Meetings*, The Institute, alternate Wednesdays during winter. *Sec.*, Edward Fenton, High Street, Braintree.

Brechin Photographic Association. — *Pres.*, Wm. Shaw Adamson, Careston Castle. *Meetings*, Rooms, 14, St. Mary Street, Third Wednesdays, September to April. *Sec.*, John M. Dunn, Bank Street, Brechin.

***Brentford Photographic Society.**—*Particulars n t received from Secretary.*

Bridge of Weir Photographic Society. — *Pres.*, W. G. Glendinning. *Meetings*, Studio, Bridge of Weir, Wednesday evenings, 8 p.m. *Sec.*, James W. McGill, Brynerw, Bridge of Weir.

***Brierley Hill and District Camera Club**—*Pres.*, Owen Gibbons. *Meetings*, Technical School, Wednesdays, October to March, 8 p.m. *Ex.*, January. *Sec.*, J. Thomas, William Street, Brierley Hill.

Brighouse Photographic Society.—*Pres.*, Dr. George A. Farrer. *Meetings*, The Studio, Town Hall Buildings, occasionally during summer, winter meetings are held every Thursday. *Secs.*, F. W. Crowther, 11, Anvil Street, Brighouse, and H. Robinson, 13, Lee Street, Brighouse.

***Bristol and West of England Amateur Photographic Association.**—*Pres.*, H. A. Hood-Daniel. *Sec.*, Guy Chilton, 34, Baldwin Street, Bristol.

***Bristol Photographic Club.**—*Pres*, John Fisher. *Meetings*, 5, St. James' Square, every alternate Tuesday, 8 p.m. *Ex.*, October. *Sec.*, Geo. Easonsmith, Central Printing Works, 2, St. Stephen Street, Bristol.

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*Bromley (Kent) Camera Club.—*Pres.*, John Scott, B.A., M.B. *Meetings*, Co-operative Hall, East Street, Friday, First and Third in months of October to April inclusive, 8 p.m. *Sec.*, Ernest W. Andrew, 90, College Road, Bromley, Kent.

*Burnley Camera Club.—*Pres.*, G. C. Ogden. *Meetings*, Mechanics' Institute, Thursday, 8 p.m. *Ex.*, November. *Sec.*, A. Jackson, 28, Clifton Street.

*Burnley Co-operative Camera Club. —*Pres.*, J. Leeming. *Meetings*, Co-operative Central Premises, Tanner Street, Tuesdays (about twice a month). *Sec.*, Ernest A. Sutcliffe, 144, Coal Clough Lane, Burnley.

Burton-on-Trent Natural History Society (Photographic Section).—*Pres.*, W. Howarth. *Meetings*, Friar's Walk, Third Tuesday in month, 8 p.m. *Sec.*, George Moore, 254, Branston Road, Burton-on-Trent.

*Bury St. Edmunds Camera Club.— *Pres.*, Mrs. Manson. *Meetings*, Masonic Hall, Chequer Square, First Wednesday, every month. *Sec.*, Owen A. Clark, 12, Abbeygate Street, Bury St. Edmunds.

*Cambridge and District Photographic Club — *Pres.*, W. Farren. *Meetings*, 1, Hobson's Passage, Second and Fourth Tuesday in each month, during winter at 8.30 p.m. *Ex.*, October 31, November 1, 2 and 3, 1906. *Sec.*, T. J. Sowdon, "Sunny Side," Guest Road, Cambridge.

Cambridge Y.M.C.A. Camera Club —*Pres.*, F. W. Bird. *Meetings*, Alexandra Hall, Second and Fourth Wednesday. *Sec.*, J. Johnson, 3, St. Andrew's Street, Cambridge.

*Cardiff Photographic Society.—*Pres.*, W. Arthur Meyrick. *Meetings*, 7 and 8, Working Street, Cardiff, Friday, 8 p.m. *Sec.*, A. E. Harris, 41, Partridge Road, Cardiff.

*Cardiff Windsor Amateur Photographic Society.—*Particulars not received from Secretary.*

*Carlisle Border City Camera Club. — *Pres.*, J. Robinson. *Meetings*, Liberal Club, Lowther Street, alternate Tuesdays, at 8 p.m. *Sec.*, Geo. H. Hill, 45, Collingwood Street, Carlisle.

*Carlisle and County Amateur Photographic Society.—*Pres.*, W. J. Pratt. *Meetings*, Art Gallery, Tullie House, alternate Wednesdays, October to March. *Sec.*, Samuel W. B. Jack, 82B, Lowther Street, Carlisle.

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Carluke Photographic Association.—*Pres.*, Richard Chalmers, *Meetings*, Rooms, Clyde Street, every Wednesday, 8 p.m. *Sec.*, Andrew Fraser, Clyde Street, Carluke.

Carnoustie Photographic Association.—*Pres.*, A. Heggie. *Meetings*, Y.M.C.A. Rooms, Second Monday of each month, at 8 p.m. *Sec.*, C. Wade, Barry Road, Carnoustie, Scotland.

Caterham Institute Camera Club.—*Pres.*, C. E. Kenneth Mees, B.Sc. *Meetings*, Caterham Institute, Caterham Valley, Mondays, 8.30 p.m., October to April. *Sec.*, J. C. Scrivener, Mistleigh, Caterham Valley.

*Catford and Forest Hill Photographic Society.—*Pres.*, Major E. F. Coates, M.P. *Meetings*, 12, Westbourne Road, Forest Hill, First and Third Mondays, 8 p.m. *Ex.*, April. *Sec.*, William Theyer Browne, 169, Woolstone Road, Forest Hill, S.E.

Central Photographic Society.—*Pres.*, Rev. F. C. Lambert, M.A. *Meetings*, Exeter Hall, Strand, W.C., Fridays, 7.30 p.m. *Sec.*, J. W. Hobday, Exeter Hall, Strand, W.C.

*Chelsea and District Photographic Society.—*Pres.*, Emslie J. Horniman. *Meetings*, South Western Polytechnic, Manresa Road, S.W., First and Third Thursdays in the month at 8 p.m. *Sec.*, F. Webb, 175, Fulham Road, S.W.

*Chester Society of Natural Science, Literature and Art (Photographic Section).—*Pres.*, Dr. Henry Stolterforth, M.A., J.P. *Meetings*, Grosvenor Museum, First and Third Fridays, 8 p.m. *Sec.*, Frank Simpson, 10, Grosvenor Street, Chester.

Chichester Photographic Society.—*Pres.*, F. B. Tompkins. *Meetings*, Technical Institute, Second Tuesday in winter, Second Thursday in summer. *Sec.*, G. M. Turnbull, J.P., Lyndhurst Lodge, Chichester.

*Chiswick Camera Club.—*Pres.*, R. P. Drage. *Meetings*, Devonshire Room, Town Hall, Tuesdays, October to April. *Sec.*, J. Mann, 9, Cambridge Road, Chiswick.

Chorley Photographic Society.—*Pres.*, H. R. Dorning. *Meetings*, The Studio, Devonshire Road, Second Wednesday in each month, 7.30 p.m. *Sec.*, J. R. Waring, 12, Bank Street, Chorley.

*City and Guilds of London Technical College, Finsbury, Photographic Society. — *Particulars not received from Secretary.*

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Cleveland Camera Club.—*Pres.*, J. J. Burton. *Meetings*, Literary and Philosophical Institution, Corporation Road, Middlesbrough, Second and Fourth Monday in Month.

Clonmel and District Camera Club.—*Meetings*, Clonmel Young Men's Institute, Gordon Street. *Sec.*, Robert Barclay, 7, Grattan Place, Clonmel, Co. Tipperary.

Coatbridge Co-operative Camera Club.—*Pres.*, Mitchell Suttie. *Meetings*, Library Hall, Dunbeth Road, First and Third Mondays of Month. *Ex.*, October. *Sec.*, Will Lawson, 57, Dunbeth Road, Coatbridge.

Coatbridge Photographic Association.—*Pres.*, John McGregor. *Meetings*, Photographic Institute, Wood Street, First and Third Thursdays. *Ex.*, October. *Sec.*, Geo. W. Campbell, Ailsa Cottage, Coatbridge.

Colne Camera Club.—*Pres.*, W. Hyde. *Meetings*, Cloth Hall, Walton Street, Friday, 8 p.m. *Sec.*, John J. Hartley, Craven Bank House, Colne.

Consett and District Photographic Society.—*Pres.*, Captain John Pethwick. *Sec.*, P. E. Sutton, Viewdale, Mount Pleasant, Consett.

***Cornish Camera Club.**—*Pres.*, R. Pearce Couch. *Meetings*, The Studio, Penzance, Second and Last Tuesday in each month from October to March. *Sec.*, H. Tonkin, 22, Market Place, Penzance.

Cornwall Central Photographic Club.—*Pres.*, Professor James Clark, M.A., D.Sc. *Meetings*, Central Technical Schools, Truro, First Friday in month. *Sec.*, Alex. Gregg, 5, Adelaide Terrace, Truro.

***Coventry Photographic Club.**—*Pres.*, W. H. McLauchlan. *Meetings*, 7, Little Park Street, Wednesday, 8 p.m., October to April. *Ex.*, March. *Sec.*, T. J. Mercer, 6, Cope Street, Coventry.

***Cowes Camera Club.**—*Pres.*, Sir Whittaker Ellis, Bart *Meetings*, Town Hall, Wednesday, 8 p.m., October to March, First Wednesday, April to September. *Sec.*, E. E. Vincent, 4, High Street, Cowes.

***Cricklewood Photographic Society.**—*Meetings*, Windmill Hotel, Broadway, Cricklewood. *Sec.*, R. G. Layman, 19, Yew Grove, Cricklewood, N.W.

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Crieff Photographic Association.—*Pres.* J. B. Whitelaw. *Meetings*, Cornton Place, Third Wednesday, October to May, inclusive, 8.30 p.m. *Sec.*, William Forbes, Balcraig, Strathern Terrace, Crieff.

*__Cripplegate Photographic Society.__—*Pres.*, George H. Depledge *Meetings*, Cripplegate Institute, Golden Lane, E.C. Second and Fourth Mondays in each month. *Ex.*, February. *Sec.*, John B. Parnham, "Chagford," Old Church Road, Chingford.

Cromer and District Photographic Society.—*Pres.*, David Dulley. *Meetings*, Jessop's Room, Cromer, First and Third Wednesdays. *Sec.*, Cyril J. C. Goodyear, Heath House, Cromer.

Crompton Camera Club.—*Pres.*, J. H. Broadbelt. *Meetings*, Club House, Collinge Street, Shaw, Lancashire, every Wednesday. *Sec.*, H. Illingworth, 22, Horton Street, Shaw, Lancashire.

Crook and District Camera Club.—*Pres.*, Wm. Laws Powell. *Meetings*, Mr. J. G. Gowland's Studio, Church Street, every alternate Tuesday. *Sec.*, Edward Lloyd, Iveston House, Crook.

*__Croydon Camera Club.__—*Pres.*, W. H. Smith. *Meetings*, 128a, George Street, Wednesday, 8 p.m. *Sec.*, Henry M. Bennett, "Alipore," Duppas Hill, Croydon.

*__Croydon Natural History and Scientific Society.__—*Pres.* W. F. Stanley, F.G.S. *Meetings*, Public Hall, Croydon. Third Tuesday September to May. *Sec.*, J. G. Lincoln, Bank Buildings, High Street, Croydon.

Darlington Camera Club.—*Pres.*, Chas. J. Barthorpe. *Meetings*, Tuesdays, 8 p.m., from October to March. *Sec.*, Harold L. Thomson, 9, Close Street, Darlington.

Darwen Photographic Association.—*Pres.*, Geo. Butterworth. *Meetings*, Belgrave Schools, Thursday, 8 p.m. *Sec.*, F. Dearnley, 31, Richmond Terrace.

Deal and Walmer Camera Club.—*Particulars received too late.*

*__Derby Photographic Society.__—*Pres.*, E. Collier Green, M.R.C.S. *Meetings*, Messrs. Cumberland's Room, The Wardwick, Second Monday in the month. *Sec.*, A. H. Bennett, 13, Wilfred Street, Derby.

Devonport Camera Club.—*Pres.*, W. Treglohan, B.A. *Meetings*, The Technical School, alternate Wednesdays. *Sec.*, Alfred J. Catford, 33, Neath Road, Plymouth.

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Dewsbury and District Amateur Photographic Society.—*Pres.*, J. E. Chadwick. *Meetings*, Law Society's Chambers, Bond Street, Mondays, October to March, 8 p.m. *Sec.*, Joseph Garside, 45, Healds Road, Dewsbury.

***Doncaster Camera Club.**—*Pres.*, Patrick Stirling. *Meetings*, The Albany Hotel, Second and Fourth Tuesdays in each month, 8.15 p.m. *Sec.*, T. Haigh Connor, 39, Market Place, Doncaster.

Dover Photographic Society.—*Pres.*, E. M. Worsfold. *Meetings*, The Dover Institute, Second and Fourth Thursday, 8 p.m. *Ex.*, January. *Sec.*, H. Plowright, 47, Maison Dieu Road, Dover.

***Dover Sciences Society.**—*Pres.*, Capt. J. Gordon McDakin. *Meetings*, High School, Maison Dieu Road, Fortnightly in winter. *Sec.*, Percy Moring, 23, Randolph Gardens, Dover.

Dukinfield Photographic Society.—*Pres.*, S. T. Ainsworth. *Meetings*, Co-operative Hall, Astley Street, Wednesdays, 8 p.m. *Sec.*, L. J. Scott, Yew Tree Lane, Dukinfield.

Dumfries and Maxwelltown Photographic Association.—*Pres.*, D. Brodie. *Meetings*, Irving Street Hall, First and Third Mondays of month. *Sec.*, T. Armstrong, 41, Moffat Road, Dumfries.

"Dundee Advertiser" Photographic Club.—*Particulars not received from Secretary.*

***Dundee and East of Scotland Photographic Association.**—*Pres.*, Archibald Campbell. *Meetings*, University College, Dundee, First Thursday, November to May (except January, Second Thursday), 7.30 p.m. *Sec.*, V. C. Baird, Broughty Ferry.

***Ealing Photographic Society.**—*Pres.*, Joseph Watson. *Sec.*, Sydney Taylor, 38, Hamilton Road, Ealing.

***Eastbourne Natural History Society** (Photographic Section). *Pres.*, J. J. Hollway. *Meetings*, Technical Institute, Eastbourne, Third Thursday in each month. *Sec.*, Frank Ash, B.Sc., Rosemead, Mayfield Place, Eastbourne.

***East Kent Scientific and Photographic Society.**—*Pres.*, S. Harvey, F.I.C., F.C.S. *Meetings*, Beaney Institute, Wednesday, 8 p.m., Fortnightly. *Sec.*, A. Lander, Medical Hall, Canterbury.

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Eccles Photographic Society.—*Pres.*, D. Lawton. *Meetings*, 18, Peel Street, Eccles, Monthly. *Sec.*, C. A. Oldham, 3, Gladstone Road, Eccles.

***Edinburgh Photographic Society.**—*Pres.*, Andrew H. Baird, F.R.P.S. *Meetings*, 38, Castle Street, Edinburgh, First, Second, and Fourth Wednesdays, October to March, and First Wednesdays, April to June. *Ex.*, February. *Sec.*, J. S. M'Culloch, W.S., 3a, North St. David Street, Edinburgh.

Edinburgh Photographic Club.—*Pres.*, Andrew H. Baird. *Meetings*, 38, Castle Street, Edinburgh, Third Wednesday, 8 p.m. *Sec.*, T. Barclay, 180, Dalkeith Road, Edinburgh.

Edinburgh University Photographic Society.—*Pres.*, Dr. J. W. Drinkwater. *Meetings*, University Union. *Ex.*, November. *Sec.*, E. Darwin Wilmot, University Union, Edinburgh.

***Edmonton and District Photographic Society.**—*Pres.*, S. J. Solly. *Meetings*, 224, Fore Street, Edmonton, alternate Wednesdays. *Sec.*, A. E. Worfolk, Main Avenue, Bush Hill Park, Enfield.

Erdington Photographic Society.—*Pres.*, Councillor W. S. Aston. *Meetings*, Public Hall, Mondays weekly October to March. Last Monday in month only April to September. *Sec.*, Thos. A. Sands, 26, Frederick Road, Gravelly Hill, Birmingham.

Erith and District Photographic Society.—*Particulars not received from Secretary.*

Everton Camera Club.—*Pres.*, W. W. Haywood. *Meetings*, 14, Village Street, Everton, Liverpool, Wednesdays, weekly in winter and fortnightly in summer. *Sec.*, William Tansley, 22, Chapel Place, Liverpool.

Evesham Camera Club.—*Meetings*, Public Library. *Sec.*, Robt. C. Mawson, 3, Victoria Avenue, Evesham.

***Exeter Camera Club.**—*Pres.*, Dr. J. D. Harris. *Meetings*, Barnfield House, alternate Mondays September to May. *Sec.*, J. W. Lake, 41, High Street, Exeter.

***Fakenham Literary Field and Camera Club.**—*Pres.*, Algernon Digby, M.A. *Meetings*, The Lancaster Rooms. *Sec.*, Henry Newson, The Square, Fakenham, Norfolk.

Falkirk Amateur Photographic Association.—*Pres.*, John Higgins. *Meetings*, Club Room, 42, Newmarket Street, Second Wednesday of month, 8.30 p.m. *Sec.*, Wm. M. Clark, 112, Thornhill Road, Falkirk.

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Finsbury Technical College Photographic Society.—*Pres.*, Professor R. Meldola. *Meetings*, Finsbury College, alternate Tuesdays. *Sec*, Faithful Davies, Technical College, Finsbury.

***Forest Gate "MM" Camera Club.**—*Pres.*, John H. French. *Meetings*, Richmond Hall (Baptist Church), Romford Road *Sec.*, Edward J. May, 183, Sebert Road.

***Gateshead Camera Club.**—*Particulars not received from Secretary.*

***Gillingham Kent) and District Amateur Photographic Society.**—*Particulars not received from Secretary.*

Glasgow and West of Scotland Amateur Photographic Association.—*Pres.*, Charles Macdonald. *Sec.*, A. Herbert Brown, C.A., 180, Hope Street, Glasgow.

Glasgow Eastern Amateur Photographic Association.—*Pres.*, John Brough. *Meetings*, 12a, Landressy Street, Bridgeton, Glasgow, every Thursday, 8 p.m. *Secs.*, Archd. Campbell, 110, Annfield Street, Dennistown, Glasgow, and John Thomson, Jr., 12, Wardlaw Avenue, Rutherglen.

Glasgow Eastern Co-operative Camera Club.—*Particulars not received from Secretary.*

Glasgow St. George's Co-operative Camera Club.—*Pres.*, J. B. Tulloch. *Meetings*, 40, Gladstone Street, Glasgow, alternate Fridays, 8 p.m. *Ex.*, September. *Sec.*, William Young, 37, Gladstone Street, Glasgow.

Glasgow Southern Photographic Association.—*Pres.*, W. H. Wilson. *Meetings*, 169, Eglinton Street, Glasgow. *Ex.*, March 23rd to April 7th. *Sec.*, Chas. Young, 217, Crow Road, Partick, Glasgow.

Glenalmond Photographic Club. — *Pres.*, Arthur S. Reid. *Meetings*, Trinity College, Glenalmond, alternate Saturdays in Term time at 9 p.m. *Ex.*, July. *Sec.*, J. N. D. Smith, Trinity College, Glenalmond, Perthshire.

***Gloucestershire Photographic Society.**—*Pres.*, Dr. Oscar Clark. *Meetings*, Municipal Schools, alternate Tuesdays in Winter. *Secs.*, Edward A. Ind and S. A. Pitcher, 36, Northgate, Gloucester.

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Glossop Y.M.C.A. Photographic Society.—*Pres.*, S. Hill Wood, J.P., D.L. *Meetings*, Y.M.C.A. Rooms, Victoria Street, Second Tuesday in the month, 8 p.m. *Sec.*, T. W. Sharpe, 85, Primrose Terrace, Glossop.

Grangemouth Amateur Photographic Association.—*Particulars not received from Secretary.*

Grange Photographic Society.—*Pres.*, Dr. Burman. *Meetings*, Victoria Hall, Second Monday in the month. *Sec.*, A. W. Hankinson, Sandhurst, Grange-over-Sands.

Grantham and District.—*Particulars not received from Secretary.*

Graphic Society, Plymouth.—*Pres.*, G. F. Treleaven. *Meetings*, once a fortnight in summer, variable in winter. *Sec.*, J. S. Hawker, Mutley House, Plymouth.

Gravesend and District Photographic Society.—*Pres.*, E. D. Ingall. *Sec.*, H. G. Levings, 14, Victoria Road, Perry Street, near Gravesend.

Gravesend Camera Club.—*Particulars not received from Secretary.*

***Great Western Railway Literary Society** (Photographic Section).—*Pres.*, Col. the Hon. C. E. Edgcumbe. *Meetings*, 44, Eastbourne Terrace, W., alternate Mondays. *Ex.*, October. *Sec.*, Fredk. W. Chubb, Surveyors' and Estate Office, Paddington Station.

Greenock Camera Club.—*Pres.*, Thomas Rowley. *Meetings*, Good Templar Hall, Kilblain Street, Thursdays, at 8 p.m., September to April. *Sec.*, R. A. D. Macalister, 39, Kelly Street.

Guild, The, Leeds.—*Committee*, P. Sheard, J. H. Gash, W. M. Coultas. *Meetings*, The Grand Restaurant, First Friday in Month. *Sec.*, R. Stockdale, 17, Mount Preston, Leeds.

***Guildford Photographic Society.**—*Meetings*, Headquarters, Guildford Institute, North Street, two meetings per month in winter. *Ex.*, April. *Sec.*, H. M. Moon, St. Audries, Churchill Road.

Guisbrough Fine Art and Industrial Society.—*Pres.*, Wm. Charlton. *Ex.*, February. *Sec.*, George Page, 34, Westgate, Guisbrough.

***Guy's Hospital Nurses' Photographic Society.**—*Pres.*, Miss S. A. Swift. *Meetings*, Nurses' Home, Guy's Hospital, Weekly. *Sec.*, Miss M. Smith, Guy's Hospital, S.E.

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***Hackney Photographic Society.**—*Pres.*, Edward Puttock. *Meetings*, Pembury Hotel, Amhurst Road, Hackney, every Tuesday, 8 p.m. *Ex.*, Second Week in November. *Sec.*, Walter Selfe, 70, Paragon Road, Hackney.

Halifax Camera Club.—*Pres.*, J. Ingham Learoyd. *Meetings*, 29, Northgate, Monday or Tuesday, October to March, inclusive, 8 p.m. *Sec.*, Lionel Dickinson, 113, Ovenden Road, Halifax.

Haltwhistle Photographic Society.—*Pres.*, Dr. W. R. Speirs. *Meetings*, Market Place. *Sec.*, D. Macadam, Haltwhistle.

Hamilton Photographic Society.—*Particulars not received from Secretary.*

***Hampstead Scientific Society** (Photographic Section).—*Pres.*, Sir Samuel Wilks, Bart., M.D., LL.D., F.R.S. *Meetings*, The Library, Stanfield House, Prince Arthur Road, Wednesdays (Fortnightly), 8.30 p.m., November to May. *Sec.*, H. Nevil Smart, 40, Compayne Gardens, W. Hampstead, N.W.

Handsworth Photographic Society.—*Pres.*, Philip Whitehouse. *Meetings*, 111, Soho Road, every Thursday at 8 p.m. *Ex.*, May. *Sec.*, A. E. Teague, 51, Linwood Road Handsworth.

Harrogate Camera Club.—*Pres.*, Riley Fortune, F.Z.S. *Meetings*, 11, Montpellier Parade, Thursdays from October to March. *Sec.*, Sam B. Lupton, Prospect Crescent, Harrogate.

***Hartlepools' Photographic and Sketching Society.**—*Pres.*, F. Yeoman, J.P. *Meetings*, Technical College, West Hartlepool, October to April, First and Third Wednesdays; April to October, First Wednesday. *Ex.*, January. *Sec.*, J. J. Rutherford, 52, Milton Road, West Hartlepool.

***Hastings and St. Leonards Photographic Society.**—*Pres.*, R. White-Ford. *Meetings*, Public Hall, Fortnightly. *Sec.*, Hubert Walter, 24, Cambridge Road, Hastings.

Heaton and District Camera Club (Newcastle-on-Tyne).—*Pres.*, J. Walton Lee. *Meetings*, Byker Road Assembly Rooms, First and Third Mondays. *Sec.*, George C. Urwin, 21, Tenth Avenue, Heaton, Newcastle-on-Tyne.

***Hemel Hempstead and District Photographic Society.**—*Particulars not received from Secretary.*

Herefordshire Photographic Society.—*Pres.*, J. S. Arkwright, M.P. *Meetings*, Clarence Rooms, West Street, Hereford. *Sec.*, F. C. Pritchard, High Town, Hereford.

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*Hillsbro' District Photographic Society.—*Particulars not received from Secretary.*

Holmfirth Photographic Society.—*Pres.*, Dr. Williams. *Meetings*, Technical Institute. *Sec.*, F. B. Shaw, Shaley Top, Holmfirth.

Hornsey St. Luke's Photographic Society.—Defunct.

Horwich Amateur Photographic Society.—*Pres.*, George Hughes. *Meetings*, Mechanics' Institute, Horwich, Tuesdays. *Ex.*, February. *Sec.*, W. A. Barnes, 121, Mason Street, Horwich.

*Hove Camera Club.—*Pres.*, A. R. Sargeant, J.P. *Meetings*, 55, Western Road, Hove, Tuesday, twice a month, October to April. *Ex.*, November. *Sec.*, W. H. Bone, 32, Sackville Road, Hove.

Huddersfield Naturalist and Photographic Society.—*Pres.*, J. H. Carter. *Meetings*, Technical College, Queen Street South, alternate Wednesday, 7.30 p.m. *Sec.*, George James Mackenzie Wicker, 7, John William Street, Huddersfield.

Hull Photographic Society.—*Particulars not received from Secretary.*

Ibis Camera Club.—*Pres.*, Sir Henry Harben. *Meetings*, 142, Holborn Bars, London, W.C. *Sec.*, W. H. Coleman, "Woodcroft," Battlefield Road, St. Albans.

*Ilford and District Photographic Society.—*Pres.*, A. R. Manr. *Meetings*, Alexandra Hall, Ilford, Monday. *Sec.*, G. Edw. Lyddon, 3, Belgrave Road, Ilford.

Ilkeston Arts Club (Photographic Section).—*Pres.*, The Mayor. *Meetings*, Free Library, First Friday in month at 8 p.m. *Ex.*, March or April. *Sec.*, A. Smith, 11, Graham Street, Ilkeston.

Ilkley and District Camera Club.—*Pres.*, Dr. Bates. *Meetings*, Club Rooms, Sedbergh Buildings, Ilkley, every alternate Thursday, commencing Oct. 25th, at 8 p.m. *Sec.*, John W. Lund, West View House, Ilkley.

*Ipswich Camera Club.—*Pres.*, Major Meller. *Meetings*, The Museum, Ipswich. *Sec.*, Stanley B. Bond, Cauldwell Hall, Ipswich.

*Ipswich Scientific Society (Photographic Section).—*Particulars not received from Secretary.*

*Isle of Man Camera Club.—*Pres.*, W. Beck. *Meetings*, Kensington House, Bucks Road, Douglas, alternate Tuesdays and Fridays at 8 p.m. *Sec.*, W. H. Skillicorn, "The Moorings," Kensington Road, Douglas.

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*Isle of Thanet Photographic Society.—*Pres.*, Rev. Canon L. J. White-Thomson, M.A. *Meetings*, Church Club, Broad Street, Ramsgate, Wednesdays, 8.15 p.m. during winter session. *Ex.*, November. *Secs.*, Capt. S. H. Page and D. C. Hogwood, 6, Queen Street, Ramsgate.

*Isle of Wight Photographic Society.—*Pres.*, Professor John Milne, D.Sc., F.R.S. *Meetings*, The Literary Institute, Quay Street, Newport, Isle of Wight. *Sec.*, J. Howard Burgess, 53, Pyle Street, Newport.

Jarrow Mechanics' Institute Camera Club.—*Pres.*, E. W. Penman. *Meetings*, Jarrow Mechanics' Institute, Tuesdays at 8.0 p.m. *Sec.*, Matthew Maughan, 16, South Wensbeck Street, Jarrow.

*Jersey Photographic Society.—*Pres.*, Dr. Stamberg. *Meetings*, Beresford Café, every Tuesday. *Sec.*, Rodney Porter, 2, South Villas, Stopford Road, Jersey.

Keighley and District Photographic Association.—*Pres.*, Wm. Robertshaw. *Meetings*, Municipal Institute, alternate Tuesdays. *Sec.*, Norman H. Barrett, Woodside, Keighley.

"Kennaway" Photographic Society.—*Pres.*, Rev. Prebendary H. E. Fox, M.A. *Meetings*, 16, Salisbury Square, London, E.C., last Monday in month. *Sec.*, W. R. C. Cooke, 16, Salisbury Square, London, E.C.

Keswick Photographic Society.—*Pres.*, J. P. Heath. *Meetings*, Keswick Library Class Room, Second and Fourth Fridays, October to March inclusive. *Sec.*, H. A. Beadle, Station Street, Keswick.

Kettering Camera Club.—*Pres.*, J. A. Gotch, F.S.A., J.P. *Meetings*, Church Institute, Newland Street, Second Thursday in month. *Sec.*, E. Claypole, 112, Hawthorn Road, Kettering.

King's Lynn Photographic Society.—*Particulars not received from Secretary.*

*Kingston-on-Thames and District Photographic Society.—*Pres.*, Rev. G. I. Swinnerton, M.A. *Meetings*, Kingston Public Library, Mondays, October to March, 8 p.m. *Secs.*, John P. East, Uxbridge House, Kingston-on-Thames, and A. W. Grant, Woodleigh, Cranes Park Avenue, Surbiton.

Kirkcaldy Photographic Society.—*Pres.*, S. Stewart. *Meetings*, Society's Room, 196, High Street, Third Monday, October to April, 8 p.m. *Sec.*, Jas. M. Harcus, Victoria Gardens, Kirkcaldy.

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Lancaster Photographic Society.—*Pres.*, R. W. Wearing. *Meetings*, Society's Rooms, Stonewell, Monday and Friday, 8 p.m. *Ex.*, November. *Sec.*, R. T. Simpson, 60, North Road, Lancaster.

Larkhall Camera Club.—*Particulars not received from Secretary.*

*__Leeds Camera Club.__ — *Pres.*, John Mackenzie. *Meetings*, "Thoresby Rooms," 10A, Park Street, Leeds, every Wednesday, October to April, alternate Wednesdays rest of Year. *Sec.*, A. Dawson Berry, 12, Hessle Avenue, Hyde Park, Leeds.

Leeds Institute (Photographic Class).—*Pres.*, Jas. E. Bedford. *Meetings*, Leeds Institute, Cookridge Street, Wednesdays and Thursdays, 7.15. *Sec.*, Arthur Tait, Leeds Institute, Leeds.

Leeds Photographic Society.—*Pres.*, T. W. Thornton. *Meetings*, Law Institute, Albion Place, Leeds, First and Third Tuesdays from October to April. *Sec.*, Joseph Fielding, 65, Rosemount Place, Tong Road, Leeds.

Leek Photographic Society.—*Pres.*, Victor Prince. *Meetings*, Rooms, St. Edward Street, Leek, every Monday and Thursday. *Sec.*, Charles Brassington, 52, Grove Street, Leek, Staffs.

*__Leicester and Leicestershire Photographic Society.__—*Pres.*, W. J. Coates. *Meetings*, Oriental Café, Market Place, Second and Fourth Wednesdays. *Ex.*, March. *Sec.*, W. Murray, 60, Melton Road, Leicester.

*__Leicester Literary and Philosophical Society__ (Section "G," Photography). — *Pres.*, L. B. M. Hodges. *Meetings*, Council Room, Museum Buildings, Second Friday, October to April. *Sec.*, R. E. Woolmer, 33, Dover Street, Leicester.

Leigh (Lancs.) Photographic Society.—*Pres.*, Dr. H. S. Hall. *Meetings*, Social Hall, Railway Road, Alternate Thursdays at 8.15 p.m. *Sec*, A. L. Makinson, Claremont, Pennington, Leigh.

Leigh Photographic Society.—*Pres.*, Dr. H. S. Hall. *Meetings*, Socialist Hall, Railway Road, Leigh, every Second Thursday, October to March. *Sec.*, A. T. Smith, The Chestnuts, Leigh, Lancs.

Leith Amateur Photographic Association.—*Pres.*, Thos. Wilson. *Meetings*, 6, Charlotte Street, Leith, Statutory Meetings Last Tuesday every month, Technical Meetings Second Friday every month. *Sec.*, W. M. Dalziel, 102, Constitution Street, Leith.

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Lewes Photographic Society.—*Pres.*, Ald. G. J. Wightman. *Meetings*, Lewes Town Hall, First Tuesday in the month, September to May, 8 p.m. *Sec.*, Geo. Carpenter, 81, High Street, Lewes.

***Liverpool Amateur Photographic Association.**—*Pres.*, Joseph Marples. *Meetings*, 9, Eberle Street, Dale Street, Thursdays, 10 to 10. *Sec.*, Chas. F. Inston, F.R.P.S., 9, Eberle Street, or 25, South John Street.

Liverpool Central Y.M.C.A. Camera Club.—*Pres.*, Richard Brown. *Meetings*, Liverpool Central Y.M.C.A., Mount Pleasant, *Sec.*, John Graham, 20, Alfred Road, Birkenhead.

Liverpool Municipal Technical Students' Association.—*Particulars not received from Secretary.*

***London and Provincial Photographic Association.**—*Trustees*—T. E. Freshwater, A. Haddon. *Meetings*, White Swan, Tudor Street, E.C., every Thursday evening, 7 p.m. *Sec.*, Herbert C. Rapson, 13, Shaftesbury Road, Hornsey Rise, N.

***London County Council Staff Camera Club.**—*Pres.*, W. T. Sadler. *Meetings*, County Hall, Spring Gardens, or Education Offices, Victoria Embankment, Fourth Thursday. *Sec.*, Philip S. White, Comptroller's Department, County Hall, Spring Gardens, S.W.

Londonderry Camera Club.—*Pres.*, Sir R. Newman Chambers, Kt. *Meetings*, 12, Strand Road, Monthly, First Wednesday. *Sec.*, R. W. Saville, 61, Beechwood Avenue, Londonderry.

Longsight and Levenshulme Camera Club.—*Particulars not received from Secretary.*

***Longton and District Photographic Society.**—*Pres.*, Dr. A. Parkes, J.P. *Meetings*, Sutherland Institute, usually First and Third Thursday, September to April. *Sec.*, Thos. Mottershead, 32, Stafford Street, Longton.

Loughborough and District Photographic Society.—*Pres.*, Walter C. Burder, J.P. *Meetings*, Temperance Hall, Last Friday, 8.15 p.m. *Sec.*, Herbert W. Cook, "Herald" Office, Loughborough.

Louth and District Photographic Society.—*Particulars not received from Secretary.*

***Luton Camera Club.**—*Pres.*, Dr. F. Seymour Lloyd. *Meetings*, Y.M.C.A. Rooms, Chapel Street, weekly on Mondays, September to Christmas. *Sec.*, William H. Cox, 90, Castle Street, Luton.

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*Lyonsdown Amateur Photographic Association.—*Pres.*, Alfred Bentley. *Meetings*, Members' houses, Second Wednesday in each month. *Sec.*, C. A. S. Koch, Ellington, New Barnet.

*Manchester Amateur Photographic Society.—*Pres.*, S. L, Coulthurst. *Meetings*, Manchester Athenæum, Second Tuesday in each month, except August, Society's Rooms, 57, Market Street, open daily, and demonstrations weekly. *Ex.*, Northern Triennial, 1909. *Sec.*, F. W. Parrott, 11, Elm Road, Altrincham.

Manchester Camera Club.—*Sec.*, Chas. Dawson, 34, Queen Street, Manchester.

Manchester Photographic Society.—*Pres.*, W. E. Wood. *Meetings*, Second Monday in each month, 7.30 p.m. *Sec.*, C. H. Coote, 10, Holmefield, Sale, Manchester.

Manchester Y.M.C.A. Photographic Club.—*Pres.*, J. W. Price. *Meetings*, 56, Peter Street, First Monday each month. *Sec.*, H. C Dumler, 56, Peter Street, Manchester.

*Margate Photographic and Scientific Society.—*Pres.*, Dr. Warwick Brown. *Meetings*, St. John's Hall, Hawley Square, Wednesday evening, 8.15 p.m. *Sec.*, H. R. Gibbs, 20, Margate Place, Margate.

Marple Wesleyan Photographic Society.—*Pres.*, J. A. Hulme *Meetings*, Wesleyan Sunday School, Marple, First and Third Saturdays, 7.30 p.m. *Sec.*, B. Hughes, 42, Church Lane, Marple.

Mid-Cheshire Society of Arts (Photographic Section).—*Sec.*, Geo. Holland, 17, Stanley Mount, Barnton, Northwich.

Midlothian Camera Club.—*Defunct.*

Millfields Road (Clapton) E.C. School Photographic Society.—*Particulars not received from Secretary.*

Morley Photographic Society.—*Pres.*, Dr. S. T. Steele. *Meetings*, Queen Street, Morley, First and Third Tuesdays. *Sec.*, Ernest B. Bradley, Worrall Street, Morley, Yorks.

Motherwell Y.M.I. Camera Club.—*Particulars not received from Secretary.*

Muirkirk Amateur Photographic Association.—*Pres.*, Rev. Jas. Greenshields. *Meetings*, Baird Institute, 8 p.m. on every Fourth Tuesday, September to May. *Sec.*, Wm. Barrowman, Kennethmont, Muirkirk.

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Nelson Photographic Society.—*Pres.*, A. E. Normington, M.B. *Meetings*, Victoria Hall, Scotland Road, every Tuesday, at 7.30 p.m. *Sec.*, Henry H. Beetham, 98, Brunswick Street, Nelson, Lancs.

*__Nelson Camera Club.__—*Pres.*, Arthur Smith. *Meetings*, Club Rooms, Co-operative Buildings, Elizabeth Street, every Tuesday evening. *Sec.*, Fred. Hartley, 4, Pickup Street, Nelson.

*__Newark Photographic Society.__—*Pres.*, J. Brown. *Meetings*, Mechanics' Institute, Newark-on-Trent, Wednesday, Fortnightly, from October to April, 8.30 p.m. *Sec.*, J. M. Burns, 71, Harcourt Street, Newark on-Trent.

Newbury Guildhall Camera Club.—*Particulars not received from Secretary.*

*__Newcastle-on-Tyne and Northern Counties' Photographic Association.__—*Particulars not received from Secretary.*

Newton Heath Camera Club.—*Pres.*, G. A. Wilson. *Meetings*, Newton Heath Wesleyan Schools, Oldham Road, Third Wednesday in each month at 8 p.m. *Secs.*, George Dunn, 101, Kenyon Lane, Moston, and J. Taylor, 103, Lightbourne Road, Moston,

*__Northampton Natural History Society and Field Club__ (Photographic Section). — *Pres.*, H. Manfield, M.P. *Meetings*, British Empire Buildings, Sheep Street. *Sec.*, C. H. Dorman, A.R.I.B.A., 53, Abington Street.

Northcote Camera Club.—*Particulars not received from Secretary.*

*__North London Photographic Society.__—*Pres.*, A. Horsley Hinton. *Meetings*, Islington Public Library, Northern Branch, Manor Gardens, Holloway Road, N., Thursday 8 p.m. *Sec.*, Charles H. Roberts, 33, Riversdale Road, Highbury, N.

*__North Middlesex Photographic Society.__— *Pres.*, H. Stuart. *Meetings*, Hanley Hall, Sparsholt Road, Crouch Hill, Wednesday, 8.15 p.m. *Sec.*, S. C. Puddy, 87, Crouch Hill, N.

*__North-West London Photographic Society.__ — *Pres.*, J. H. Mansfield. *Meetings*, Y.M.C.A. Buildings, Camden Road, N.W., usually Second and Fourth Thursdays, September to March. *Ex.*, February. *Sec.*, Henry S. Date, 3a, Woodsome Road, Highgate Road, N.W.

*__Norwich and District Photographic Society.__—*Pres.*, A. E. Coe. *Meetings*, Strangers' Hall, Norwich, First Monday in every month, October to May. *Ex.*, February—March. *Sec.*, J. T. Tanner, The Ledge, Bowthorpe Road, Norwich.

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***Nottingham Camera Club.**—*Pres.*, Arthur Marshall, F.R.P.S. *Meetings*, Mechanics' Institution, Fortnightly (in winter only). *Ex.*, March. *Sec.*, S. W. Barlow-Vines, Market Chambers, South Parade, Nottingham.

Oldham Equitable Photographic Society.—*Pres.*, William Mann. *Meetings*, Co-operative Stores, Greenwood Street, Mondays, 7.30 p.m. *Ex.*, March. *Sec.*, Chas. Ledger, 6, Airey Street, Oldham.

Oldham Photographic Society.—*Pres.*, J. H. Brierley. *Meetings*, Trust Buildings, Manchester Street, every Thursday at 8 p.m. *Sec.*, William Taylor, 176, Coppice Street, Oldham.

Otley and District Camera and Art Society.—*Pres.*, A. Marshall. *Meetings*, Wesley Street, Tuesday, 7.45 p.m. *Sec.*, Fred. T. Taylor, Bridge Street, Otley, Yorks.

Outer Hebrides Photographic Society.—*Particulars not received from Secretary.*

***Oxford Camera Club.**—*Pres.*, Sir W. J. Herschel, Bart. *Meetings*, University Museum, Second and Fourth Mondays in each month. *Sec.*, Geo. W. Norton, 149, Woodstock Road, Oxford.

Padiham Photographic Society.—*Meetings*, Technical Institute, every Tuesday evening. *Sec.*, John Hoole, 1, Moor Lane, Padiham.

Paisley Philosophical Institution (Photographic Section).—*Pres.*, John Stewart. *Meetings*, 28, Oakshaw Street, alternate Thursdays during winter session. *Sec.*, Hugh F. Hamilton, Glaisnock, Bank Street, Paisley.

Perthshire Society of Natural Science (Photographic Section).—*Pres.*, Henry Coates, F.R.S.E. *Meetings*, Museum, Tay Street, Second and Fourth Tuesdays, November to April. *Sec.*, A. Mackenzie, 8, Scott Street, Perth.

***Peterborough Photographic Society.**—*Pres.*, Geo. Kirkwood, M.D. *Meetings*, Bedford Temperance Hotel, Fortnightly in winter. *Sec.*, T. J. Calcutt, 46, Narrow Street.

***Photographic Club.**—*Meetings*, Red Cross Hotel, Paternoster Square, London, E.C. Wednesdays at 8 p.m. *Sec.*, T. W. Derrington, 1, Clarence Road, Wimbledon, S.W.

***Photographic Society of Ireland.**—*Pres.*, Hugh Pollock. *Meetings*, 35, Molesworth Street, Second and Fourth Friday from October to April inclusive, 8 p.m. *Ex.*, May. *Secs.*, R. Benson, Claremont, Orwell Park, Rathgar, Co. Dublin, and A. Ponton, 32, Shelbourne Road, Dublin.

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*Plymouth Photographic Society.—*Pres.*, J. T. Johnson. *Meetings*, The Athenæum, George Street, alternate Fridays, 8 o'clock. *Ex*, May. *Sec.*, Alfred W. Hicks, 14, Wolseley Terrace, Mutley, Plymouth.

Plympton Photographic Society.—*Pres.*, Dr. Aldridge. *Sec.*, T. H. Wilks, Plympton House, Plympton, Devon.

*Polytechnic Photographic Society.—*Pres.*, Howard Farmer. *Meetings*, 309, Regent Street, W., Thursday, 8.15 p.m. *Sec.*, Charles E. Crake, 28, Shooter's Hill Gardens, Eltham Park, Kent.

Preston Camera Club.—*Pres.*, John Toulmin. *Meetings*, Stanley Chambers, Lancaster Road, Preston. Lectures every Monday evening. *Sec.*, Laban Yates, Pear Tree Brow, Penwortham, Preston.

*Preston Scientific Society (Photographic Section).—*Pres.*, W. Phillips. *Meetings*, 119A, Fishergate, Tuesday, 8 p.m. *Ex.*, First Week in February. *Sec.*, A. W. Cooper, 31, Kenmure Place, Garstang Road, Preston.

Pudsey and District Photographic Society.—*Pres.*, M. V. Wilson. *Meetings*, Mechanics' Institute, Robin Lane, Monthly in Summer, during Winter, 8 p.m. every Thursday. *Sec.*, W. Green, Green Top House, Pudsey.

Queen's Park Amateur Photographic Association.—*Pres.*, William Pirrett. *Meetings*, 9, Smith Street, Govanhill, First and Third Thursdays of each month. *Sec.*, John Moir, 644, Cathcart Road, Glasgow.

*Reading and District Photographic Society.—*Particulars not received from Secretary.*

Redcar and Coatham Literary Institute Photographic Society.—*Particulars not received from Secretary.*

*Redhill and District Camera Club.—*Pres.*, A. H. Dunning, *Meetings*, North Room, Market Hall, Redhill. *Ex.*, November. *Sec.*, E. E. Robinson, Broadfield, Reigate.

*Richmond Camera Club.—*Pres.*, F. P. Cembrano. *Meetings*, Freemasons' Club, 2, Sheen Road, Richmond, Thursday evenings, 8.30 p.m., October to April. *Sec.*, J. A. Abbott, St. Leonard's House, East Sheen, S.W.

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Rochdale Amateur Photographic Society.—*Pres.*, Isaac Renshaw. *Meetings*, Lyceum, Bailie Street, Rochdale, alternate Wednesdays from October 7.45 p.m. *Sec.*, Geo. A. Mather, 38, Emma Street, Rochdale.

Rodley, Farsley and Calverley District Photographic Society.—*Pres.*, Wm. Whittaker. *Meetings*, alternately at Rodley, Farsley and Calverley, Fortnightly in Winter, Thursdays, 8 p.m., and in Summer, Monthly. *Sec.*, H. Crossley, Rodley, near Leeds.

***Rotherham Photographic Society.**—*Pres.*, E. Isle Hubbard. *Meetings*, Frederick Street, First Tuesday in month. *Ex.*, October. *Sec.*, Henry C. Hemmingway, Tooker Road, Rotherham.

Royal Cornwall Polytechnic Society.—*Pres.*, Bishop of Ripon. *Meetings*, Polytechnic Hall, Falmouth. *Ex.*, September. *Sec.*, E. W. Newton, 4, Cross Street, Camborne, Cornwall.

***Rugby Photographic Society.**—*Pres.*, B. B. Dickinson, M.A., *Meetings*, Physical Lecture Room, Rugby School, alternate Thursdays, October to April. *Ex.*, November. *Sec.*, R. H. Myers, 13, Bridget Street, Rugby.

***St. Albans Photographic Society.**—*Pres.*, W. J. Armitage. *Meetings*, Laboratories, St. Albans School, alternate Fridays. *Sec.*, Charles H. Ashdown, F.R.G.S., F.C.S., &c., Monastery Close, St. Albans.

St. Helens Camera Club.—*Pres.*, J. Leyland. *Meetings*, 32, Church Street, every Tuesday, 8 p.m. *Ex.*, March. *Sec.*, John Glover, 14, Ormskirk Street, St. Helens.

St. Michael's Photographic Society.—*Particulars not received from Secretary.*

Sale Photographic Society.—*Pres.*, H. V. Kilvert. *Meetings*, Sale Public Hall, Wednesdays, 8 p.m. *Sec.*, J. Pilkington, Brooklands, Cheshire.

Scarborough and District Photographic Society.—*Pres.*, E. L. Davis. *Meetings*, Museum Library, Monday, 8 p.m. *Sec*, Frank Foster, 16, Victoria Road, Scarborough.

Seaham and District Camera Club.—Defunct.

Sefton Park, Liverpool, Photographic Society.—*Particulars not received from Secretary.*

Shaw Church Institute Photographic and Art Society.—*Pres.*, R. H. Harnwell. *Meetings*, Shaw Church Institute, Second Tuesday at 8 p.m. *Sec.*, John Maiden, 93, Rochdale Road, Shaw, near Oldham.

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Sheffield and Hallamshire Photographic Society.—*Pres.*, F. Mottershaw. *Meetings*, Cemetery Road Baptist Schools, Second Wednesday in each month. *Sec.*, Fred Lowe, 41, Carrington Road, Sheffield.

Sheffield Friends' Schools Photographic Society.—*Pres.*, Robert Wilson. *Meetings*, Friends' School, Hartshead, Third Thursday in month at 8 p.m. *Ex.*, February. *Sec.*, John Varley, 107, Ripon Street, Attercliffe, Sheffield.

***Sheffield Photographic Society.**—*Pres.*, J. W. Charlesworth. *Meetings*, Builders' Exchange, Cross Burgess Street, First and Third Tuesday in month, 7.30 p.m. *Ex.*, February *Sec.*, James W. Wright, 62, Vale Road, Sheffield.

Shettleston and District Camera Club.—*Pres.*, D. Hannington. *Ex.*, December. *Sec.*, Wm. Kitson, Hawthorn Villa, Shettleston.

Shotts Camera Club.—*Pres.*, A. W. Hill, J.P. *Meetings*, Club Rooms, Station Road, Shotts. *Sec.*, James Twaddle, Calderside. Terrace, Shotts.

***Shropshire Camera Club** — *Particulars not received from Secretary.*

Simpson Memorial Camera Club.—*Pres.*, Dr. A. T. Lakin. *Meetings*, Simpson Memorial, alternate Fridays in winter at 8 p.m. *Sec.*, W. H. Tyas, Jun., Oak Bank, Blackley, Manchester.

Skipton Photograhic Society.—*Pres.*, A. H. Dawes. *Meetings*, Science and Art Schools, Skipton, Second and Fourth Fridays, 8 p.m. *Sec.*, F. E. Dodson, Town Hall, Skipton.

***Slough Photographic Society.** — *Pres.*, Ernest Oetzmann *Meetings*, Leopold Institute, Slough, Mondays at 8.15 p.m. during Autumn and Spring. *Sec.*, Norman E. Brown, The Red Cottage, Bath Road, Slough.

Small Heath Photographic Society.—*Pres.*, C F. Hayward. *Sec.*, H. A. Pinfield, 73, Wordsworth Road, Small Heath.

***Southampton Camera Club.**—*Pres.*, W. Burrough Hill, F.S.I. *Meetings*, Philharmonic Hall, all Mondays from October to March inclusive, and the other Six Months, alternate Mondays. *Ex.*, December. *Sec.*, S. G. Kimber, Oakdene, Highfield, Southampton.

South Devon Teachers' Camera Club.—*Pres.*, A. W. Searley. *Meetings*, First Saturday in every month. *Sec.*, Chas. Mole, Broadhempston, Totnes.

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*Southend-on-Sea Photographic Society.—*Pres.*, Alderman J. R. Brightwell. *Meetings*, Technical School, First and Third Thursdays, September to May. *Ex.*, April. *Sec.*, John Archer 24, Ashburnham Road, Southend-on-Sea.

*South Essex Camera Club.—*Pres.*, Walter D. Welford, F.R.P.S. *Meetings*, Wakefield Hall, East Ham, 8 p.m., Second and Fourth Wednesdays. *Ex.*, January. *Sec.*, T. Michell, 180, Browning Road, Manor Park, E.

Southland Camera Club.—*Particulars not received from Secretary.*

*South London Photographic Society.—*Pres.*, C. H. Oakden, Esq. *Meetings*, Collyer Hall, Collyer Place, High Street, Peckham, S.E., every Monday, October to February, at 8 p.m., First and Third Mondays, March to September. *Ex.*, March. *Sec.*, A. H. Downey, "The Laurels," Slaithwaite Road, Lewisham, S.E.

South Manchester Photographic Society.—*Pres.*, H. Ashby, M.D., F.R.C.P. *Meetings*, 43, Lapwing Lane, West Didsbury. *Sec.*, Jas. H. Haywood, 102, Clyde Road, West Didsbury.

South Norwood Photographic Society.—*Pres.*, John Smith. *Meetings*, Public Hall, Station Road, South Norwood, S.E., every Thursday Evening during Winter Session, alternate Thursdays during Summer Session. *Ex.*, November. *Sec.*, Wilfred E. Mullen, 25, Carew Road, Thornton Heath, Surrey.

*Southport Photographic Society.—*Pres.*, J. S. Dickin. *Meetings*, Baths Café, 54, Nevill Street, Mondays each week, 8 p.m. *Sec.*, Albert E. Sharples, 89, Tulketh Street, Southport.

*Southsea Photographic Society.—*Pres.*, H. A. Canning. *Meetings*, 5, Pembroke Road, Portsmouth, every Wednesday, 8.30 p.m. *Ex.*, November. *Sec.*, I. S. Hoyte, "Lismore," Stafford Road, Southsea.

South Shields Photographic Society—*Particulars not received from Secretary.*

Stafford Photographic Society.—*Pres.*, Chas. E. Fowke. *Meetings*, Messrs. Weiss and Fowke's Studio, Victoria Road, First Tuesday and Third Monday (October to May). *Sec.*, Herbert A. E. Hey, Tillington, Stafford.

Stirling and District Photographic Society.—*Pres.*, James Johnston. *Meetings*, Club Rooms, Corn Exchange, Fortnightly on Thursdays. *Sec.*, John Walker, 67, King Street.

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Stockport Photographic Society. — *Pres.*, Dr. Brennan. *Meetings*, Mechanics' Institute, Second and Fourth Wednesdays in month, except December. *Sec* , T. W. Goodison, 28, Wellington Road N., Stockport.

Stoke Newington Princess May Camera Club.—*Particulars not received from Secretary.*

***Stratford—G. E. R. Mechanics' Institution** (Photographic Section).—*Pres.*, J. Holden, M.I.C.E., M.I.M.E. *Meetings*, G.E.R. Mechanics' Institution, Store Street, Stratford, E., Wednesdays, October to May. *Ex.*, March. *Sec.*, A. Woolford, 16, Grove Green Road, Leytonstone, E.

Sunderland Camera Club.—*Pres.*, Selby Ord. *Meetings*, alternate Tuesdays, 7.30 p.m. *Sec.*, Oscar Möller, 1, Thornhill Gardens, Sunderland.

***Sunderland Photographic Association.**—*Pres.*, William Milburn. *Meetings*, Subscription Library, First and Third Thursday, 7.30 p.m. *Sec.*, William E. Kieffer, Stirling Street, Sunderland.

***Sutton Photographic Club.**—*Pres.*, Hector Maclean, F.R.P.S. *Meetings*, Public Hall Chambers, Friday, 8.15 p.m., First and Third in month during winter session. *Sec.*, C. Thwaites, M.Inst. C.E., F.R.A.S., Burnell Road, Sutton, Surrey.

***Swansea Camera Club.**—*Pres.*, Trevor Owen, M.A. *Meetings*, 14 and 15, Temple Street, Monday. *Sec.*, W. R. Stephens, 15, Temple Street, Swansea.

Tamworth and District Photographic Society. — *Pres.*, W. T. Carrick. *Meetings*, 15, Market Street. First and Third Tuesday. *Sec.*, John W. Parker, 17, Heath Street, Tamworth.

***Thornton Heath Photographic Society.**—*Pres.*, Walter Wood. *Meetings*, 86, High Street, Tuesday, 8 p.m. *Sec.*, J. H. Robertson, 54, Torridge Road, Thornton Heath.

Torbay Camera Society.—*Pres.*, Col. W. F. Macmullen. *Meetings*, Wellswook Hall, Torquay, First Friday of the month, 3.30 p.m. *Sec.*, Geo. Drury, "Delmonte," Waldon Hill, Torquay.

Tring Camera Club.—*Pres.*, The Hon. N. Charles Rothschild. *Meetings*, Constitutional Club, First Wednesday, 7.30 p.m. *Ex.*, November. *Sec.*, Richard F. Auber, Downs Villa, Tring.

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*Tunbridge Wells Amateur Photographic Association.—*Pres.*, F. G. Smart, M.A. *Meetings*, Club Room, Mechanics' Institute, Dudley Road, First Thursday and Third Wednesday, 8.15 p.m. *Sec.*, Joseph Chamberlain, Tankerville, Cambridge Street, Tunbridge Wells.

Tynemouth, Borough of, Photographic Society.—*Pres.*, W. Coats, Jnr. *Meetings*, Presbyterian Hall, North Shields, First and Third Thursday in winter months, 8 p.m. *Sec.*, J. B. Scott, 2, Walton Avenue, North Shields.

Tyneside Camera Club.—*Particulars not received from Secretary.*

Tyneside Geographical Camera Club.—*Meetings*, News Room, Geographical Institute, First Wednesday in each month. *Sec.*, John Scott, 10, Mosley Street, Newcastle-upon-Tyne.

*Ulster Photographic Society.—*Pres.*, S. W. Allsworthy, M.A., M.D., F.C.S. *Meetings*, The Museum, College Square North, Belfast, First Mondays, October till April (inclusive), 8 p.m. *Sec.*, J. D. M. McCallum, The Museum College, College Square North, Belfast.

Wakefield Photographic.—*Pres.*, Alfred Darley. *Meetings*, Church Institution, Wakefield. Friday, 8 p.m., Fortnightly. *Sec.*, F. W. Tattersall, 7, Freeston Terrace, Normanton.

Walkley (Sheffield) Camera and Optical Lantern Society.—*Pres.*, W. J. Booth, Esq. *Meetings*, First Thursday in month 8.30. *Sec.*, S. Hall-Downing, 292, South Road, Sheffield.

Wallasey Amateur Photographic Society.—*Pres.*, Rev. A. Ernest Parry. *Meetings*, 110, Brighton Street, Seacombe, alternate Mondays *Sec.*, W. Hayes, 110, Brighton Street, Seacombe.

*Wallington Camera Club.—*Pres.*, Rev. H. A. Hodgson, M.A. *Meetings*, Sterndale Hall, Wallington Fourth Tuesday in each month. *Sec.*, John A. Lash, London and South-Western Bank, Wallington.

Walsall Photographic Society.—*Pres.*, Alderman W. Hughes. *Meetings*, The Assembly Rooms, The Square, Weekly, every Thursday evening at 8 p.m. *Ex.*, March. *Sec.*, W. T. Comer, 6 and 4, Arcade, Walsall.

*Walthamstow Photographic Society.—*Pres.*, W. A. Longmore. *Meetings*, The Hall, Vestry Road, Walthamstow. *Meetings*, First and Third Mondays in the month, at 8 p.m. *Secs.*, Thomas R. Nunn, 29, The Drive, Walthamstow; J. S. Fairfoull, 13 Addison Road, Walthamstow

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Walton (Liverpool) Photographic Society.—*Pres.*, F. Murphy. *Meetings*, Walton Church (Old) Schools, First Wednesday in each month, 8 p.m. *Sec.*, T. Bickerstaffe, 79, Rawcliffe Road, Walton, Liverpool.

*__Wandsworth Camera Club.__—*Pres.*, Dr. Mark Robinson. *Meetings*, 106, High Street, First and Third Mondays from October to April. *Sec.*, A. E. Slocombe, 58, Swaffield Road, Wandsworth, S.W.

*__Warrington Photographic Society.__—*Pres.*, F. V. L. Mathias, A.M.I.E.E. *Meetings*, Old Academy, Bridge Street, Tuesday, 7.45 p.m. *Ex.*, May. *Sec.*, A. C. Smithson, 13, Chester Road, Warrington.

*__Watford Camera Club.__—*Pres.*, The Lord Hyde. *Meetings*, 100, High Street, every Thursday at 8.30 p.m. *Ex.*, October-November. *Sec.*, Edwin H. Jackson, 100, High Street, Watford, or 5, Lower Derby Road, Watford, Herts.

*__Watford Photographic Society.__—*Pres.*, H. Snowden Ward, F.R.P.S. *Meetings*, Watford Public Library, alternate Fridays, 8 p.m. during winter months. *Ex.*, April. *Sec.*, C. J. Trevarthen, Grove Cottage, Bushey Hall Road, Watford.

*__Wearside Camera Club.__—*Particulars not received from Secretary.*

*__"Wellcome" Photographic Club.__—*Pres.*, Henry S. Wellcome. *Meetings*, Wellcome Club and Institute, Dartford, Kent. *Sec.*, H. C. Sayer, Wellcome Club, Dartford.

__Wesley Camera Club.__—*Pres.*, G. Blackledge. *Meetings*, Wesley School, Abbey Street, Accrington. *Sec.*, Rd. Kenyon, 8, Beaconsfield Street, Accrington.

*__West Bromwich Photographic Society.__—*Pres.*, Stephen J. Holliday. *Meetings*, Crowther's Rooms, Paradise Street, Thursdays, 8 p.m. *Sec.*, Albert Bye, Bilhay Street, West Bromwich.

__West Calder Camera Club.__—*Pres.*, R. W. Brown. *Meetings*, Photographic Club Rooms, No. 4 Room, adjoining People's Hall, Second Tuesday of each month at 8 p.m. *Ex.*, September. *Sec.*, L. Girdwood, 27, Hermand, West Calder.

*__West London Photographic Society.__—*Pres.*, George Lamley, F.R.P.S. *Meetings*, Broadway Lecture Hall, Hammersmith, W. alternate Fridays, 8 p.m., *Ex.*, February. *Sec.*, Jordan R Lynch, Jr., 160, Holland Park Avenue, London, W.

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*West Surrey Photographic Society.—*Pres.*, Dr. H. Pelham Webb. *Meetings*, The Railway Hotel, Battersea Rise, Wednesday, 9 p.m. *Sec.*, Chas. A. Clear, 10, Grandison Road, Clapham Common, S.W.

West Wight Camera Club, Freshwater, I.W.—*Meetings*, Rookwood, Totland Bay, I.W., First and Third Thursdays. *Sec.*, Ernest A. Levane, Rookwood, Totland Bay, I.W.

*Weymouth Photographic Society.—*Pres.*, C. E. A. George. *Meetings*, Technical Schools, Weekly, Friday. *Ex.*, April. *Sec.*, Lewis H. T. Chave, Gloucester House Esplanade, Weymouth.

Whitby Camera Club.—*Pres.* W. Brown. *Meetings*, Cliff Street Council Schools, Fridays at 8 p.m. *Sec.*, Woodhouse Parkinson, Ocean Road, West Cliff, Whitby.

Widnes Photographic Society.—*Pres.*, J. W. White. *Meetings*, Bedford Chambers, alternate Tuesdays, 7.30 p.m. *Sec.*, J. Birkenhead, 30, Albert Road, Widnes.

*Willesden Polytechnic Photographic Society.—*Pres.*, W. B. Luke. *Meetings*, Polytechnic, Priory Park Road, Kilburn, N.W., First and Third Mondays, October to May inclusive. *Sec.*, Geoffrey E. Peachey, 83, Walm Lane, N.W.

*Wimbledon and District Camera Club. - *Particulars not received from Secretary.*

*Windsor Camera Club.—*Pres.*, Sir Francis Barry, Bart. *Meetings*, Royal Albert Institute. *Ex.*, February. *Sec.*, Thomas J. Cartland Thames Side, Windsor.

Wishaw Photographic Association.—*Pres.*, Alexander Symon, M.A., B.Sc. *Meetings*, Association Rooms, Stanley Place, Young Street, First Tuesday of month at 8 p.m. *Ex.*, December-January. *Sec.*, Robert Telfer, 138, Glasgow Road, Wishaw.

*Wolverhampton Photographic Society —*Pres.*, James Gale. *Meetings*, Lymelofte, Compton Road, First Monday and Third Wednesday (usually) 8 p.m. *Sec.*, Fred. R. Turton, 6, Bath Road, Wolverhampton.

*Wolverton Literary and Scientific Society (Photographic Section).—*Pres.*, G. M. Fitzsimons. *Meetings*, Science and Art Institute, Church Street, Tuesdays (alternate) 7 p.m. *Sec.*, Charles Edgar Whitlock, 9, Buckingham Street, Wolverton, Bucks.

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*Woodford Photographic Society.—*Pres.*, E. H. Carpenter. *Hon. Sec. and Treas.*, F. G. Ember.

*Woolwich Photographic Society.—*Pres.*, C. Churchill, *Meetings*, St. John's Schools, Wellington Street, Second and Fourth Thursday, October to April inclusive, at 8 p.m. *Sec.*, S. A. Saffron, 19, Winchester Street, Silvertown.

Worcestershire Camera Club and Photographic Survey Society.—*Pres.*, The Right Hon. Earl Beauchamp, K.C.M.G., *Meetings*, 1A, High Street, Worcester. *Sec.* (*Sur.*), Francis J. Shaw, Parkhurst, Victoria Avenue, Worcester. *Sec.* (*Gen.*), Geo. Harry Haycox, St. Wulstan's Crescent, Worcester.

Workington Photographic Society.—*Pres.*, W. L. Fletcher. *Meetings*, Juvenile Room, Free Library, First and Third Tuesdays. *Sec.*, John R. Taylor, 15, Station Road, Workington.

Worthing Camera Club.—*Pres.*, Colonel Arthur Henty, J.P. *Meetings*, The Club, 11, Liverpool Terrace, summer Third Wednesday and First Saturday, winter alternate Tuesday, 8.15 p.m. *Ex.*, March. *Sec.*, Edmund F. H. Crouch, 11, South Street, Worthing.

*Yarmouth, Great, District Camera Club.—*Pres.*, Dr. A. H. Meadows. *Meetings*, 156, King Street, Second Tuesday in each month. *Sec.*, J. S. Shearman, 156, King Street, Great Yarmouth.

*Yorkshire Philosophical Society (Photographic Section).—*Pres.*, Tempest Anderson, M.D., J.P. *Meetings*, The Museum, York, First Wednesday of each month October to May inclusive, 8 p.m. *Secs.*, H. Dennis Taylor, Stancliffe, Mount Villas, York, and Malcolm Spence, Almerygarth, Marygate, York.

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POSTAL CLUBS.

Amateur Photographic Field Club. *Sec.*, Basil E. Laurence, LL.D., 12, Strathray Gardens, South Hampstead, London, N.W.

Anglo-Celtic Postal Photographic Society.—*Sec.*, A. Emerson Morris, 23, Sea View, Port Talbot.

Architectural Postal Photographic Club.—*Sec.*, J. E. Underwood, Bedford Square, Loughborough

"Argosy" Postal Photographic Club.—*Sec.*, Rev. C. F. L. Barnwell, Stramshall Vicarage, Uttoxeter.

Aurora Lantern Slide Exchange Club.—*Sec.* Rev. T. Perkins, Turnworth Rectory, Blandford.

"Boys' Own" Photographic Club.—*Sec.*, James Hardwick, 14, Azalea Terrace South, Sunderland.

British Postal Camera Club.—*Sec.*, Griffith William Perkins, 18, Arundel Road, Tunbridge Wells.

Camera & Co. Postal Club.—*Sec.*, H. Wild, "Kinnellar," Eden Road, Tunbridge Wells.

Camerists' Postal Photographic Club.—*Sec.*, Arthur Turner, 99, Carr Road, Walkley, Sheffield.

Hampstead Postal Photographic Club.—*Sec.*, H. Harvey Pepper, The Elms, Chapter Road, Willesden Green, N.W.

Hand Camera Postal Club.—For advanced work. *Sec.*, Geo. V. Myatt, Kempston, Rodwell, Weymouth.

Lantern Slide Exchange Club.—*Sec.*, J. S. Hawker, Mutley House, Plymouth.

Light and Truth Postal Photographic Club.—*Sec.*, G. H. Haycox, Hazeldean, St. Wulstan's Crescent, Worcester.

Perseverance Postal Camera Club.—*Sec.*, G. A. Towers, 120, Cambridge Street, Rugby.

Postal Camera Club.—*Sec.*, J. C. Warburg, 21, Pembridge Gardens, W.

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Postal Pictorial Photography Club, The.—*Sec.*, Mrs. M. C. Cottam, "Burleigh," Church Road, Bournemouth.

Ripon Portfolio Club.—*Sec.*, H. Bulmer Rudd, 29, Westgate, Ripon.

Secretaries' Postal Photographic Society, The.—A circulating folio exclusively for hon. secs. of photographic societies, dealing with general matters relating to photography, and the working of societies, clubs, &c. *Sec.*, S. G. Kimber, Oakdene, Highfield, Southampton.

Somerset Postal Photographic Society, The.—For Advanced Workers. *Sec*, Bernard J. Mitchell, 2, Willow Vale, Frome.

Stereoscopic Society, The.—*Sec.*, B. Diveri, B.A., Viewfield, Huntly, N.B.

Sun and Company Postal Club.—*Sec.*, Martin J. Harding, Old Bank House, Church Stretton, Salop.

Talbot Album Club.—*Sec.*, Fred. H. Langdon-Davies, Adelaide Square, Bedford.

The Wye Valley Postal Photographic Club.—*Sec.*, Francis J. Lindley, 113, Seymour Road, Gloucester.

Wessex Photographic Postal Club.—*Sec*, Rev. T. Perkins Turnworth Rectory, Blandford.

Zodiac Camera Club.—For Advanced Pictorial Workers. *Sec.* Miss Agnes B. Warburg, 8, Porchester Terrace, Hyde Park, W.

Zoological Photographic Club.—*Sec.*, Chas. Louis Hett, Springfield, Brigg.

MANUFACTURERS & PATENTEES
MORGAN & KIDD
RICHMOND LONDON · S·W·

COLONIAL PHOTOGRAPHIC SOCIETIES.

Adelaide Amateur Camera Club.—*Pres.*, Geo. Laughton. *Meetings*, 17, Waymouth Street, Adelaide, First and Third Wednesdays. *Sec.*, W. E. Hill, Chester Place, Unley, South Australia.

**Amateur Photographic Association of Victoria.*—*Pres.* H. C. Mais, M.Inst.C.E. *Meetings*, Furlong's Studio, Royal Arcade, Melbourne. *Sec.*, D. W. Paterson, 487, Collins Street, Melbourne.

Auckland Camera Club.—*Pres.*, E. W. Payton. *Meetings*, Club Room, 39, Victoria Street, Second Monday in month. *Sec.* A. Graham, 43, George Street, Auckland.

Ballarat Camera Club.—*Pres.*, H. Adair. *Meetings*, School of Mines, Ballarat, Second Tuesday in each month at 8 p.m. *Ex.*, May. *Sec.*, Gordon Montgomery, Sturt Street, Ballarat, Victoria.

Bathhurst Amateur Camera Club.—*Pres.*, E. T. Webb. *Meetings*, Second Thursday each month. *Sec.*, H. J. Baldwin, Bathhurst, New South Wales.

Beechworth Camera Club.—*Pres.*, C. Hembrow. *Meetings*, Public Library, Beechworth, Victoria, Second Thursday in each month, 8 p.m. *Sec.*, R. W. Lover.

Bendigo Amateur Photographic Association.—*Pres.*, J. G. Austen. *Meetings*, School of Mines, every alternate Thursday 8 p.m. *Ex.*, June. *Sec.*, Jas. Miller, Bath Corner, Bendigo, Victoria.

Bombay Photographic Society.—*Pres.*, Prof. T. K. Gajjar, M.A., B.Sc., F.C.S., etc. *Meetings*, The Techno-Chemical Laboratory, Girgaum, Bombay. *Secs.*, Bomanji Dorabji Padamji and Vasanji P. Dalal, M.A., B.Sc., Techno-Chemical Laboratory, Girgaum, Bombay.

**Cape Town Photographic Society.*—*Pres.*, J. D. Cartwright, M.L.A. *Meetings*, Old Town House, Greenmarket Square. First Thursday in month. *Sec.*, Andrew Jas. Fuller, F.R.P.S. P.O. Box 470, Cape Town, South Africa.

Castlemaine Amateur Camera Club.—*Pres.*, H. McBean. *Meetings*, School of Mines, Castlemaine, alternate Wednesdays. *Sec.*, C. A. Northcote, Market Square, Castlemaine, Victoria.

FOR
GASLIGHT·PAPERS
WITH·DEVELOPING·TABLETS

Christchurch Photographic Society. *Pres.*, A. W. Fielder. *Sec.*, A. C. McIntyre, 179, Hereford Street, Christchurch, N.Z.

Cowra (N.S.W.) School of Arts Amateur Photographic Society.—*Pres.*, S. Stevenson. *Meetings*, Cowra School of Arts, Third Tuesday of each month. *Sec.*, John P. McPhee, Kendal Street, Cowra, New South Wales.

Dai-Nippon Shashin Kyokwi (Photographic Association of Japan). — *Pres.*, H. E. Viscount M. Nagaska. *Meetings*, Kwazoku-Kwaikan, 1, Uchiyamashitacho, Tokyo. *Sec.*, K. Ogura, 77, Minami-Enokimachi, Ushigome, Tokyo.

Dunedin Photographic Society.—*Sec.*, J. Stuart White, 98, Princes Street, Dunedin, N.Z.

East Malvern Amateur Photographic Club.—*Pres.*, Rev. J. B. Gason. *Meetings*, St. John's Hall, Finch Street, East Malvern, Second Friday in the month at 8 p.m. *Sec.*, Sydney Fox, "Almalea," Dandenong Road, East Caulfield, Victoria.

Gordon College Amateur Photographic Association.—*Pres.*, J. B. Leitch. *Meetings*, Gordon Technical College, Geelong, Every Friday at 8 p.m. *Sec.*, C. T. Seeley, 83, Yarra Street, Geelong, Victoria.

Gulgong Amateur Photographic Society. — *Pres.*, Archdeacon Geer. *Meetings*, Club Room, every alternate Tuesday. *Sec.*, A. P. Lambert, Public School, Gulgong, New South Wales.

Hamilton Association Camera Club, Canada.—*Pres.*, J. M. Eastwood. *Meetings*, Hamilton Association Rooms, Public Library. *Sec.*, W. Henry Edwards, 168, Main Street E., Hamilton, Ontario, Canada.

Hawke's Bay Camera Club.—*Pres.*, F. W. Williams. *Meetings*, Napier, N.Z. *Sec.*, T. Bruce Bear, c/o Napier Gas Co., Ltd., Napier, N.Z.

Ipswich Amateur Photographic Society.—*Pres.*, J. H. Barkell. *Meetings*, Second Friday in each month. *Sec.*, C. E. Greenham, Ipswich, Queensland.

***Johannesburg Photographic Society.**—*Pres.*, J. Percy Fitzpatrick. *Meetings*, Reliance Buildings, Kerk Street. *Sec.*, H. C. Haddon, Box 4822, Johannesburg, Transvaal.

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Kapunda Photographic Club.—*Pres.*, Rev. Geo. Williams. *Meetings*, School of Mines, every alternate Tuesday, 7.30 p.m. *Ex.*, April, 1907. *Sec.*, Thos. Warner, Chapple Street, Kapunda, South Australia.

Manawatu Camera Club, Palmerston North, N.Z.—*Pres*, Mr. Friberg. *Sec.*, T. Haughton Watson, Box 168, Palmerston North, N.Z.

***Maritzburg Camera Club.**—*Pres.*, D. M. Eadie. *Meetings*, Hardy's Chambers, First Wednesday and Third Thursday. *Sec.*, A. R. Hopkins, 4, Hardy's Chambers, Printing Office Street, Pietermaritzburg, Natal.

Melbourne Working Men's College Photographic Club.—*Pres.*, Professor Kernot, M.A., M.E. *Meetings*, College Lecture Hall, Latrobe Street, Melbourne, alternate Tuesdays, at 8 p.m. *Sec.*, C. R. Du Rieu, "Luxemburg," Alexandra Street, Northcote, Melbourne, Australia.

Montreal Camera Club, Canada.—*Pres.*, George Sumner. *Meetings*, 4, Phillip's Square, Montreal, Canada. *Sec.*, A. Clarence Lyman, 157, St. James' Street, Montreal, Canada.

Montreal Amateur Athletic Association Camera Club.—*Pres.*, Gordon A. Melville. *Meetings*, M.A.A.A. Building, 250, Peel Street, Montreal, First and Third Tuesdays. *Sec.*, C. F. G. Johnson, 250, Peel Street, Montreal, Canada.

Nelson Camera Club.—*Pres.*, C. Y. Fell. *Meetings*, Hardy Street, Third Tuesday in month, 7.30 p.m. *Ex.*, October. *Sec.*, H. A. Hobbs, Hardy Street, Nelson, New Zealand.

Newcastle and District Camera Society.—*Pres.*, J. T. Williams. *Meetings*, 43, Hunter Street, alternate Tuesdays. *Sec.*, Montague W. Cramp, Fleming Street, Islington, Newcastle, New South Wales.

New South Wales Railway and Tramway Camera Club.—*Pres.*, H. Maclachan. *Meetings*, Railway Institute, Radfern, First Monday in each month. *Sec.*, J. Scoular, Railway Institute, Radfern, N.S.W.

Northern Suburbs Camera Club, New South Wales.—*Pres.*, W. A. Gullick. *Meetings*, Pymble Club Hall, Third Monday in each month, 8 p.m. *Sec.*, N. McIntosh.

FOR

ENLARGEMENTS

BROMIDE·CARBON·PLATINOTYPE

*Northern Tasmanian Camera Club.—*Pres.*, R. C. Kermode. *Meetings*, Club Rooms, Launceston, Third Wednesday in the month at 8 p.m. *Ex.*, February. *Sec.*, F. Styant-Browne, 112, Brisbane Street, Launceston, Tasmania.

Perak Amateur Photographic Society.—*Pres.*, L. Wray, M.I.E.E., F.Z.S., etc. *Meetings*, Poverty Flat, Museum Road, Taiping. *Sec.*, Geo. Bain, Taiping, Perak.

Photographic Association of Canada.—*Pres.*, H. S. Park. *Meetings*, London, Ontario, Canada. *Sec.*, Thomas D. Hastings, 169, Dundee Street, London, Ontario, Canada.

Photographic Employee's Association of New South Wales.—*Pres.*, J. C. Cruden. *Meetings*, Queen's Hall, Pitt Street, Sydney, Third Monday in each month. *Sec.*, Walter Davies, 58, Cavendish Street, Petersham, Sydney, N.S.W.

Photographic Society of India.—*Pres.*, A. F. Norman. *Meetings*, Club and Dark Rooms, 10, Chowringhee, Calcutta, First Monday of month. *Sec.*, T. R. Pratt, 40, Chowringhee, Calcutta.

*Photographic Society of New South Wales.—*Pres.*, His Honour Judge Docker. *Meetings*, 149, King Street, Sydney. *Sec.*, F. E. Manning, Box 829, G.P.O., Sydney, N.S.W., Australia.

*Queensland Photographic Society.—*Pres.*, C. J. Pound. *Meetings*, Technical College, Ann Street, Brisbane, Second Thursday each month, 8 p.m. *Sec.*, T. F. Illidge, 104–106, Eagle Street, Brisbane, Queensland.

St. John Camera Club, Canada.—*Meetings*, 65, William Street, St. John, New Brunswick. *Sec.*, J. Kaye Allison, P.O., Box 401, St. John, N.B., Canada.

*South Australian Photographic Society.—*Pres.*, F. A. Joyner. *Meetings*, Institute, North Terrace, Adelaide, Second Thursday of each month. *Ex.*, September. *Sec.*, A. H. Kingsborough, 51, Rundle Street, Adelaide, South Australia.

Toronto Camera Club.—*Pres.*, Edmund E. King. *Meetings*, Forum Building, Yonge Street, Toronto, Ontario. *Sec.*, John J. Woolrough, 32, Cottenham Street, Toronto, Ontario, Canada.

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Upper Canada College Camera Club.—*Meetings*, Upper Canada College, Toronto, Ontario. *Sec.*, O. M. Biggar, 249, Simcoe Street, Toronto, Ontario, Canada.

***Wanganui Camera Club.**—*Pres.*, C. W. Babbage. *Meetings*, Club Room, Ridgeway Street. *Sec.*, G. Bolton, Bank, New South Wales, Wanganui, New Zealand.

***Wellington Camera Club, N.Z.**—*Pres.*, A. de B. Brandon. *Meetings*, Exchange Buildings, Lambton Quay, Second Thursday in each month. *Sec.*, J. A. Heginbotham, Wellington, New Zealand.

West Australian Photographic Society (Perth).—*Meetings*, Third Wednesday in each month. *Sec.*, A. R. L. Wright, Public Works, Department, Perth, West Australia.

AMERICAN SOCIETIES.

The inclusion of a list of Photographic Societies in the United States is discontinued as the space in the text portion of the "Almanac" is appropriated by information of more general interest. Since only a small proportion of the readers of the "Almanac" are in a position to make any use of this American directory, the Editor believes he is consulting the wishes of the majority in omitting it from the present and future editions. The directory of American societies last appeared in the "Almanac" for 1905.

FOR
COLLOTYPE
POST CARDS — VIEW PUBLICATIONS

PHOTOGRAPHIC BODIES.

Under the following heading are arranged particulars of the chief photographic associations which cannot be appropriately included in the list of photographic societies.

THE PROFESSIONAL PHOTOGRAPHERS' ASSOCIATION.

In Affiliation with the Chambre Syndicale de la Photographie et de ses Applications, of Paris.

HON. SECRETARY'S OFFICE: A. Mackie, 89, Albany Street, N.W.

The Association was founded in March, 1901, for the purpose of promoting the interests of professional photography, the assistance of its members in their business dealings, and rendering them advice and assistance when in legal or other difficulties.

All professional photographers in business for themselves, or as managers of firms or companies, are entitled to membership.

The subscription is 5s. per annum.

Members' meetings are held on the second Fridays in October and January. The annual general meeting is held on the second Friday in March. The meetings are held at the Royal Photographic Society, 66, Russell Square, W.C.

The committee meets the second Friday in each month, except July, August, and September.

The Association grants certificates of competency to photographic operators, assistants, etc.

Members are entitled to transfer existing fire policies to a first-rate office at premiums 20 per cent. less than they are paying.

The Association publishes a handbook annually containing much valuable information concerning copyright and other laws which particularly affect photographers. The P. P. A. Circular, published quarterly, in addition to information concerning the work of the Association, also contains much useful information upon matters of interest and importance to professional photographers.

There are branches of the Association at Aberdeen, Edinburgh, Hull, and Liverpool.

OFFICERS, ETC.

PRESIDENT: Martin Jacolette.

PAST PRESIDENT: T. C. Turner (Hull).

COMMITTEE:

London.	Country.
Bridge, F. A.	Abraham, G. P. (Keswick).
Ellis, Alfred.	Bacon, W. H. Newcastle).
Elliott, Ernest C.	Birtles, T. (Warrington).
Fry, Herbert S.	Chapman, J.P., H. A. (Swansea).
Hull, H. Edmonds.	Gill, Wm. (Colchester).
Mackie, Alex.	Lankester, P. (Tunbridge Wells)
Mendelssohn, H. S.	Moffat, F. P. (Edinburgh).
Prodger, Daniel.	Mowll, A. F. (Liverpool).
Scamell, Edgar.	Robinson, R. W. (Redhill).
Sims, Lang.	Rowe, T. (Eastbourne).
Willson, R. Fellows.	Spink, H. C. (Brighton).
	Webster, C. W. (Chester).

HON. SECRETARY: Alexander Mackie, 89, Albany Street, London, N.W.

HON. TREASURER: Lang Sims, 437, Brixton Road, London, S.W.

HON. SOLICITOR: P. E. Marshall, 35, Bedford Row, London, W.C.

AUDITORS: C. H. Skillman and Frank Turner.

HON. SECRETARIES OF LOCAL BRANCHES: Aberdeen—G. W. Morgan, Union Street, Aberdeen. Edinburgh—F. P. Moffat, 125, Princes Street, Edinburgh. Hull—T. C. Turner, Regent's Terrace, Hull. Liverpool—Wm. Warrington, 34, Bold Street, Liverpool.

PROFESSIONAL PHOTOGRAPHERS' SOCIETY OF NEW YORK.

PRESIDENT.—Pirie McDonald.

MEETINGS.—Murray Hill Hotel, New York.

SECRETARY.—Walter E. Talbot, Schenectady, New York, U.S.A.

The objects of this Society are the betterment of the profession, and creating, fostering, and maintaining cordial relations between its members.

THE PHOTOGRAPHIC CONVENTION OF THE UNITED KINGDOM.

The twenty-second annual meeting will be held in Hereford in July, 1907, under the presidency of Alfred Watkins. Retiring president—E. J. Humphery, M.A. The Photographic Convention was founded in 1886 for the advancement of photography, and to afford opportunities for personal intercourse and exchange of ideas amongst those interested in the art from all parts of the United Kingdom.

Meetings have been held at the following centres:—Derby, Glasgow, Birmingham, London, Chester, Bath, Edinburgh, Plymouth, Dublin, Shrewsbury, Leeds, Great Yarmouth, Glasgow (second visit), Gloucester, Newcastle-on-Tyne, Oxford, Cambridge, Perth, Derby (second visit), Dublin (second visit), and Southampton.

PAST PRESIDENTS.—J. Traill Taylor, Andrew Pringle, C. H. Bothamley, George Davison, William Bedford, George Mason, Sir Howard Grubb, A. Haddon, H. P. Robinson, F. P. Cembrano, John Stuart, William Crooke, Thos. Bedding, Sir William Herschel, Bart., Sir Robert Ball, Sir Robert Pullar, G. Herbert Strutt, and Professor John Joly, D.Sc.

The Council of the Convention is empowered to make grants in aid of photographic research.

MEMBERS OF COUNCIL:—

G. W. Atkins (Elstree).
G. B. Bainbridge (Morpeth).
Harold Baker (Birmingham).
Godfrey Bingley (Leeds).
W. Bromhall (Wimbledon).
Geo. E. Brown (London).
Henry Coates (Perth).
C. C. Cook (Southampton).
F Martin Duncan (London).
W. E. Dunmore (London).
Alfred Ellis (London).
S. H. Fry (London).
T. K. Grant (London).
A. E. Henley (Southampton).
A. Horsley Hinton (London).
C. B. Keene (Derby).
Sydney Keith (Hounslow).
C. Phipps Lucas (London).
F. J. Mortimer (London).
A. F. Mowll (Liverpool).
G. W. Norton (Oxford).
Rev. T. Perkins, M.A. (Blandford).
Walter F. Potter (London).
Ralph Robinson (Redhill).
J. A. C. Ruthven (Dublin).
F. G. Ryder (Southampton).
P. R. Salmon (London).
F. H. Sanderson (Cambridge).
T. Scotton (Derby).
A. Seaman (Chesterfield).
H. M. Smith (London).
W. H. Smith (Purley).
Henry Spink (Brighton).
W. Taylor (Leicester).
J. H. Walker (Leeds).
E. J. Wall (London).
H. Snowden Ward (London).
J. B. B. Wellington (Elstree).
A. Werner (Dublin).
S. H. Wratten (Croydon).

TRUSTEES.—Frederick Albert Bridge, and Major-General Waterhouse.

HON. LOCAL SECRETARY: W. T. Carless, Hereford.

HON. GENERAL SECRETARY AND TREASURER.—F. A. Bridge, East Lodge, Dalston Lane, London, N.E.

PHOTOGRAPHIC COPYRIGHT UNION.

PRESIDENT.—Frank Bishop.

VICE-PRESIDENT.—Alfred Ellis.

COMMITTEE.—W. E. Downey, Martin Jacolette, Wm. Magrath, F. M. Sutcliffe, Warwick Brookes.

TREASURER.—J. Lillie Mitchell.

SECRETARY.—Henry Gower, 23, Soho Square, London, W.

THE ARTISTIC COPYRIGHT SOCIETY.

PRESIDENT.—*Sir Lawrence Alma-Tadema, R.A.

ACTING VICE-PRESIDENT.—*Frank Dicksee, R.A.

GENERAL COMMITTEE.—*George W. Agnew (Chairman), Lockett Agnew, *Edwin Bale, R.I., Francis Bate, Sir Wyke Bayliss, P.R.S.B.A., Frank Bishop, G. H. Boughton, R.A., H. Scott-Bridgwater, Thomas Brock, R.A., Walter Dowdeswell, *Luke Fildes, R.A., A. C. Gow, R.A., Algernon Graves, F.S.A., *J. F. E. Grundy, O. Gutekunst, A. H. Haig, R.E., W. Hatherell, R.I., E. B. Haynes, Marcus B. Huish, Seymour Lucas, R.A., J. Macwhirter, R.A., W. Q. Orchardson, R.A., *Joseph B. Pratt, T. E. Scrutton, K.C., Cyril Spottiswoode, W. Reynolds-Stephens, Carmichael Thomas, Alexander Tooth, and Adolph Tuck.

SOLICITOR.—Herbert Voysey.

HONORARY TREASURER.—*C. Morland Agnew.

HONORARY SECRETARY.—*D. Croal Thomson.

ASSISTANT SECRETARY.—John Major, 39B, Old Bond Street, London, W.

This Society has announced as its first activity "the endeavour to push through Parliament a Copyright Bill, such as will be acceptable to its members and beneficial to the community at large."

EXTRACTS FROM THE RULES.

That the Society is formed with the object of promoting the interests of all concerned in artistic copyright.

That the attention of the Society shall be specially directed to the improvement, amendment, and codification of the laws relating to artistic copyright in the United Kingdom, and to the promotion of a Bill in Parliament to that end, and eventually to induce the Colonial Legislatures to bring their copyright laws into line with those of the United Kingdom.

That a further object of the Society shall be to take such steps as may be deemed necessary or advisable to prevent piracy or infringement of artistic copyrights, and

To give information on copyright questions to members of the Society.

That painters, sculptors, architects, designers, engravers, owners of works of art, print publishers, print sellers, dealers in works of art, photographers, and all interested in the subject of artistic copyright shall be eligible for membership of the Society.

That election of members shall be vested in the Committee. Application for membership to be made to the Honorary Secretary in writing.

That the annual subscription be £1 1s., payable on January 1.

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* These form the Executive Sub-Committee.

THE NATIONAL PHOTOGRAPHIC RECORD ASSOCIATION.

PRESIDENT.—Sir J. Benjamin Stone, M.P.

HON. SECRETARY.—Geo. Scamell, 21, Avenue Road, Highgate, London.

The Association has been founded for the purpose of forming a National Photographic Record of existing objects of interest throughout the British Isles. The photographs are intended to be deposited in the British Museum for public reference. The photographs are in no way restricted to archæological subjects, but include ethnological, geographical, geological subjects, etc. The Central or Standing Committee will receive all prints for the British Museum collection, and, if approved, will mount and deposit them in the British Museum. All arrangements for deposits in county or other museums will be left to local Societies that have undertaken the photographic survey of their respective counties. Prints to be in platinum or some other permanent process, and whole plate, $8\frac{1}{2} \times 6\frac{1}{2}$, to be considered standard size.

MEMBERS OF COUNCIL.

The Right Hon. the Earl of Crawford, K.T.
Sir E. Maunde Thompson, K.C.B., D.C.L.
Sir H. Trueman Wood, M.A.
F. R. Armytage.
George E. Brown, F.I.C.
C. E. Fagan.
L. Fletcher.
H. W. Fincham.
A. V. Haslam.
A. Horsley Hinton.
St. John Hope.
B. E. Lawrence, LL.D.
A. Mackie.
J. W. Marchant.
G. A. T. Middleton.
Dr. H. R. Mill.
N. B. Stone.
H. Snowden Ward.
Mrs. Catherine Weed Ward
H. B. Wheatley, F.S.A.

PHOTOGRAPHIC SURVEY ASSOCIATIONS.

PHOTOGRAPHIC SURVEY OF EDINBURGH AND DISTRICT.

SECRETARY.—Jas. Burns, Edinburgh Photographic Society, 38, Castle Street, Edinburgh.

PHOTOGRAPHIC SURVEY OF ESSEX.

SECRETARY.—V. Taylor, Essex Museum of Natural History, Romford Road, Stratford. (Letters to "Hurstleigh," Buckhurst Hill.)

PHOTOGRAPHIC SURVEY OF KENT.

PRESIDENT.—Sir David Salomons.

SECRETARY.—H. F. Winegent, Castle Gate, Rochester

PHOTOGRAPHIC SURVEY AND RECORD OF SURREY.

PRESIDENT.—Rt. Hon. Viscount Midleton.

SECRETARY.—Frank F. Wood, 22, Mint Walk, Croydon.

PHOTOGRAPHIC SURVEY OF SUSSEX.

SECRETARY.—J. C. Stenning, Public Library and Museums, Brighton.

PHOTOGRAPHIC SURVEY OF WARWICKSHIRE.
PRESIDENT.—Sir J. Benjamin Stone, M.P.
SECRETARY.—Geo. Whitehouse, 7, Wye Cliff Road, Handsworth, Staffs.
HON. CURATOR (to whom all prints should be sent).—P. T. Deakin, 19, Digbeth, Birmingham.

PHOTOGRAPHIC SURVEY OF WORCESTERSHIRE.
SECRETARY, Walter W. Harris, 101, High Street, Worcester.

THE LINKED RING.

THE Linked Ring is composed of a number of photographic workers with artistic aims. They conduct the Photographic Salon, an annual exhibition of selected pictures at 5A, Pall Mall East, London, W.C. The members of the Linked Ring are as follows:—C. Yarnall Abbott, A. Alexandre, Bernard Alfieri, J. Craig Annan, Ernest R. Ashton, W. Smedley Aston, Harold Baker, Walter Benington, Shapoor N. Bhedwar, David Blount, F. A. Bolton, Maurice Brémard, Tom Bright, Maurice Bucquet, Arthur Burchett, A. Buschbek, W. A. Cadby, Mrs. Carine Cadby, Eustace Calland, H. Hay Cameron, Lyonel Clark, A. L. Coburn, Archibald Cochrane, Hector Colard, Walter L. Colls, Reginald Craigie, J. Cruwys-Richards, L. David, George Davison, F. Holland Day, Robert Demachy, Mary Devens, W. B. Dyer, R. Eickemeyer, Charles Emanuel, Frank Eugene, Frederick H. Evans, Col. J. Gale, John Pattison Gibson, Karl Greger, Georges Grimprel, J. M. C. Grove, Hugo Henneberg, A. Hildesheimer, A. Horsley Hinton, Frederick Hollyer, Charles Job, Mrs. Gertrude Kasebier, Alexander Keighley, Joseph T. Keiley, Heinrich Kühn, Rouillé Ladevèze, Viscount Maitland, Thomas Manly, Alfred Maskell, Baron A. de Meyer, Charles Moss, Ward Muir, C. Puyo, Ralph W. Robinson, Mrs. Margaret Russell, Otto Scharf, Mrs. E. L. Watson-Schütze, Mrs. Sarah C. Sears, Dr. F. von Spitzer, Eduard J. Steichen, Alfred Stieglitz, Edmund Stirling, J. Strakosch, Frank M. Sutcliffe, Carl Ulrich, J. B. B. Wellington, H. Van der Weyde, Clarence White, and W. Willis.

Mr. John H. Anderson appears in the latest list of members.

Secretary of the Linked Ring:—Frederick H. Evans, 34, Fox Hill, South Norwood, S.E.

Secretary of the Photographic Salon:—Reginald Craigie, Corner Cottage, Wimbledon Common, S.W.

THE AFFILIATION OF PHOTOGRAPHIC SOCIETIES

WITH THE ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN.
CHAIRMAN.—The Right Hon. the Earl of Crawford, K.T., F.R.S.
CHAIRMAN OF EXECUTIVE COMMITTEE: C. H. Oakden, F.R.P.S.
HON. SECRETARY.—J. McIntosh, 66, Russell Square, London, W.C.

BENEFITS AND PRIVILEGES.—Affiliated Societies are entitled to the following benefits and privileges:—

The loan of illustrated lectures on photographic and kindred topics, sets of lantern slides, lantern lectures, pictures for exhibition, etc., and interchange of lectures and lecturers between the affiliated societies.

Permits to photograph (see below).

Two copies of each issue of the "Photographic Journal," in which are published the proceedings of the Affiliation Committee, the Transactions of the Royal Photographic Society of Great Britain, etc.

Admission to the Annual Exhibition of the Royal Photographic Society of Great Britain at reduced prices.

Members of affiliated societies joining the Royal Photographic Society of Great Britain receive exemption from the payment of entrance fee, provided they have been for at least two years members of an affiliated society. The secretaries and delegates of affiliated societies are empowered to propose and second the nominations of such candidates.

Temporary use of the accommodation provided by the various societies to members away from their own districts.

Annual competitions of pictorial photographs and lantern slides are arranged.

JUDGES OF COMPETITIONS.—A Board of Judges is prepared to meet three or four times per annum, at 66, Russell Square, to adjudicate upon competitions arranged by affiliated societies. The exhibits must be sent to the secretary with full details of the competition, and it is to be understood that the judges will follow the rules adopted by the conference of judges (see below). The judges will not undertake to criticise any work submitted.

MANAGEMENT.—Every affiliated society has a voice in the management of the affiliation through the two delegates which each is entitled to appoint. The general body of delegates meet at least twice a year, the business in the meantime being conducted by an executive committee. The two delegates appointed by each society need not necessarily be members of the society they represent. The entire income of the Affiliation is placed by the Royal Photographic Society in thee hands of the Executive Committee, which has to defray all expenses in connection with the work of the Affiliation with the following exceptions: the Royal Photographic Society provides meeting-rooms, office accommodation, and clerical assistance free of charge; it also permits its secretary to act as hon. secretary of the Affiliation.

PERMITS TO PHOTOGRAPH.—Arrangements have been made whereby members of affiliated societies will be permitted to photograph in or at the following places without other formality than the production of the Red Book (which is non-transferable), if required by those in charge. This permission is subject to any special arrangements that may be made from time to time by the authorities, and it should be understood that these concessions are granted as a matter of grace and not as rights. Holders of the Red Book are expected to act accordingly:—Bristol Cathedral, Hereford Cathedral, Lichfield Cathedral, Romsey Abbey, Burnham Beeches, *Bushey Park, Coulsdon Common, Farthingdown, Kenley Common, Riddlesdown, West Wickham Common, *Green Park, *Greenwich Park, *Hampton Court Park, Gardens and

Green, Highgate Wood, *Hyde Park, *Kensington Gardens, *Kew Green, Queen's Park (Kilburn), *Natural History Museum Gardens, *Parliament Square Gardens, *Primrose Hill, *Regent's Park, *Richmond Park and Green, *St. James's Park, St. Paul's Churchyard (to 12 noon), *Victoria Tower Gardens.

The societies forming the affiliation are indicated by a * in the list of photographic societies preceding and following.

CONFERENCE OF JUDGES.—The following rules and recommendations concerning photographic exhibitions, adopted by a meeting of judges, convened by the affiliation on April 11, 1900, and revised in June, 1903, have received the approval of the judges, whose names are published annually in the Photographic Red Book. The committee of the affiliation entertain the hope that every affiliated society will endeavour to conform to them as closely as possible. The rules are known to have proved decidedly beneficial in the past.

RULES.—1. The judges' decision upon the merit of the exhibits shall be final, and they shall not be asked to decide any other point.

2. The judges shall have full power to withhold any award, and this shall be stated in the prospectus.

3. The judges shall have power to exclude all persons from the room while judging.

4. The judges' expenses shall be paid.

5. The judges shall not adjudicate upon pictures exhibited as produced with wares of special trading firms.

6. No award shall take the form of a money prize.

7. Where there is a champion class, pictures which have previously taken awards in Open classes shall be exhibited in the champion class only.

8. An award shall be made to one picture only, whether it is in print, lantern slide, or other form; but in cases where the exhibition rules provide for slides to be exhibited in sets, the award shall be made to the best slide in the best set.

9. There shall be no distinction between amateur and professional.

10. No production of any kind whatever from the same negative shall receive more than one award at the same exhibition. This includes lantern slides, enlargements, etc.

11. No award shall be made to a lantern slide until it has been projected on the screen.

12. No award shall be given for pictorial work that is not solely the work of the exhibitor, and it shall be stated on the entry form to what extent the work sent for competition is that of the exhibitor.

13. That the names of those who have consented to act as judges shall be printed in the prospectus of the exhibition.

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* In those places indicated by an asterisk only *hand cameras* may be used under this permit, and the photographing of persons or groups is not permitted

RECOMMENDATIONS.—14. Where the judges make more than one award to the same competitor, all these should be published in the award list, although there be an exhibition regulation debarring a competitor from receiving more than one prize.

15. The judges should have power to give extra awards where they may think fit.

16. In order to enhance the value of awards their number should be limited.

17. The Exhibition Committee should not accept offers of awards from trading firms.

18. It is desirable not to have classes. Where there are classes their number should be kept as small as possible, and divisions, where made, should be entirely respecting "subject," such as portraiture, landscape, etc., and not such as hand camera classes, enlargement classes, etc.

THE SCOTTISH PHOTOGRAPHIC FEDERATION.

PRESIDENT.—Sir John Ure Primrose, Bart., LL.D.

SECRETARY.—John B. Maclachlan, Blairgowrie.

This Federation is open to all Scottish societies, including photographic sections of scientific and other societies, also to unattached photographers. Its object is to consider and provide means for the mutual benefit, encouragement, and protection of the federated societies, their members and individual photographers attached to the Federation. Special features of the organisation are the photographic "experts," who have been appointed to advise associates on various photographic matters, and "reporters," who represent the Federation in the various districts described in the Gazetteer in the "Blue-book." The "Blue-book" is the official certificate of associate-ship, and contains full particulars and information concerning the Federation. The Federation promotes annually the Scottish National Photographic Salon—the representative Scottish photographic exhibition. The 1907 exhibition will be held at Paisley, February 23 (Salon Secretary, V. C. Baird, Broughty Ferry).

The federated societies are as follows:—Aberdeen Photographic Association, Aberdeen Photographic Art Club, Airdrie (Monklands) Photographic Society, Barrhead Amateur Art Club, Blairgowrie and District Photographic Association, Bonnybridge Amateur Photographic Association, Brechin Photographic Association, Bridge of Weir Camera Club, Carnoustie Photographic Association, Coatbridge Co-operative Camera Club, Cowlais Co-operative Camera Club, Crieff Photographic Association, Denny and District Photographic Association, Dumfries Photographic Association, "Dundee Advertiser" Photographic Club, Edinburgh University Photographic Society, Glasgow Eastern Amateur Photographic Association, Glasgow Eastern Co-operative Camera Club, Glasgow Photographic Society, Glasgow Southern Photographic Association, Glenalmond Photographic Club, Grangemouth Amateur Photographic Association, Greenock Camera Club, Hamilton Photographic Association, Kinning Park Co-operative (Govan) Camera Club, Kirkcaldy Photographic Society, Kirriemuir Amateur Photographic Society, Lark-

hall Camera Club, Motherwell Young Men's Institute Camera Club, Muirkirk Amateur Photographic Association, Outer Hebrides Photographic Society, Paisley Philosophical Institute (Photographic Section), Perthshire Society of Natural Science (Photographic Section), Queen's Park Amateur Photographic Association, Shettleston Camera Club, Shotts Camera Club, St. George's Co-operative Camera Club, Stirling and District Photographic Club, West Calder Camera Club, and Wishaw Photographic Association.

Particulars of these societies will be found under "Photographic Societies."

THE YORKSHIRE PHOTOGRAPHIC UNION.

PRESIDENT.—F. Atkinson (Hull).

SECRETARY.—Ezra Clough, 10, Farncliffe Road, Bradford.

HON. SECRETARY (Lantern Slide Section).—W. H. Houghton, King's Mill Lane, Huddersfield.

HON. SECRETARY (Print Portfolio Section).—Lionel Dickinson, 113, Athol Mount, Ovenden, Yorks.

The following are the main objects of the Union:—

1. Intercourse and exchange of opinion between the members of one society and another.
2. United action for the purposes of exhibitions, or dealing with any questions of importance to photographers connected with the Federation—such as questions of principle relative to railway charges, etc.; privileges for working in places of interest not open to the general public, etc.
3. Interchange of prints and lantern slides.
4. Interchange of lecturers and lectures.
5. An annual excursion.
6. An annual meeting, to be held at some important centre during the month of April, and taking the form of an exhibition, a conversazione, or otherwise, as circumstances may render desirable.
7. Special railway fares.
8. Competitions in different branches of photography.
9. The provision of a staff of judges, available for exhibitions and competitions.

A list of lecturers and available lectures is published annually.

Societies comprising the Union:—Batley Photographic, Birstall Photographic, Bradford Photographic, Brighouse Photographic, Burnley Camera Club, Cleveland Camera Club, Colne Camera Club, Crossgates Camera Club, Dewsbury Photographic, Doncaster Camera Club, Halifax Camera Club, Harrogate Camera Club, Holmfirth Photographic, Huddersfield Photographic, Hull Photographic, Idle Photographic, Ilkley Photographic, Keighley Photographic, Leeds Camera Club, Leeds Photographic, Morley Photographic, Nelson Photographic, Otley Camera Club, Pudsey Photographic, Redcar Photographic, Rodley Photographic, Scarboro' Photographic, Sheffield Photographic, Skipton Photographic, Wakefield Photographic, York Photographic Society.

Particulars of these Societies will be found under "Photographic Societies."

THE LANCASHIRE AND CHESHIRE PHOTOGRAPHIC UNION.

PRESIDENT.—Dr. C. Thurstan Holland, F.R.P.S.

SECRETARY.—W. Tansley, 22, Chapel Place, Liverpool.

OBJECTS OF THE UNION.

The following are the main objects of the Union:—

1. Intercourse and exchange of opinion between the members of one society and another.

2. United action for the purposes of exhibitions, arranged by the Union, or dealing with any question of importance to photographers connected with the Federation—such as questions of principle relative to railway charges, etc.; special railway fares and privileges for working in places of interest not open to the general public, etc.

3. Interchange of lecturers, lectures—prints and lantern slides.

4. An annual excursion, at the discretion of the council.

5. Competitions in different branches of photography, and the provision of a staff of judges available for exhibitions and competitions.

6. An annual meeting to be held at a time and place appointed by the council, which shall take the form of an exhibition, a conversazione, or otherwise, as circumstances may render desirable.

A year-book is published, with a list of lecturers and demonstrators, etc.

SOCIETIES COMPRISING THE UNION.

Accrington Camera.
Ashton-under-Lyne Photographic
Barrow-in-Furness Naturalists'.
Birkenhead Photographic.
Blackburn Camera.
Blackburn and District Photographic.
Bolton Amateur.
Bootle Photographic.
Burnley Camera.
Burnley Co-operative Camera.
Bury Athenæum Photographic.
Chorley Photographic.
Colne Camera.
Crompton Camera.
Darwen Photographic.
Dukinfield Photographic.
Everton Camera.
Grange Photographic.
Horwich Amateur Photographic.
Lancaster Photographic.
Leigh Photographic.
Liverpool Amateur Photographic.
Manchester Amateur Photographic.
Nelson Photographic.
Oldham Photographic.
Padiham Photographic.
Preston Camera.
Preston Scientific.
Rochdale Amateur.
St. Helens Camera.
St. Matthew's (Bootle) Camera.
Sale Photographic.
Sefton Park Photographic.
Simpson Memorial Camera.
South Manchester Photographic.
Southport Photographic.
Stockport Photographic.
Wallasey Amateur.
Walton Photographic.
Warrington Photographic.
Widnes Photographic.

Particulars of these societies will be found under "Photographic Societies."

THE FEDERATION OF THE PHOTOGRAPHIC SOCIETIES OF NORTHUMBERLAND AND DURHAM.

PRESIDENT.—W. S. CORDER, J.P.

SECRETARY—J. B. Scott 1, Bedford Terrace, Bedford Street, North Shields.

The objects of the Federation are the interchange of lecturers and lectures, etc. Intercourse and exchange of opinions between the members of the societies and special privileges obtained by united action. Co-operation for the purposes of exhibition, etc. The societies included in the Federation are as follows—Bishop Auckland P.S., Blaydon C.C., Blyth and District C.C., Consett P.S., Crook and District C.C., Gateshead Teachers N.H.S. (P.S.), Hartlepool P. and S.S., Jarrow C.C., Newcastle and N.C.P.A., Seaham and District C.C., South Shields P.S, Sunderland C.C., Tynemouth P.S.

Particulars of these societies will be found under "Photographic Societies."

THE AMERICAN FEDERATION OF PHOTOGRAPHIC SOCIETIES.

SECRETARY.—Wm. T. Knox, 279, Washington Street, New York City, U.S.A.

Founded for the advancement of pictorial photography, the encouragement of photographic record, etc. The American Salon is promoted annually by the Federation, and after the first exhibition in New York makes a tour of some twelve leading centres. In Washington the Salon is held in the Concoran Galleries, in Pittsburg in the Carnegie Institute, in Chicago in the Arts' Institute. The Federation includes at present about twenty photographic societies.

THE PHOTO-SECESSION.

DIRECTOR—Alfred Stieglitz, 1111, Madison Avenue, New York, U.S.A.

Place of Meeting, 291, Fifth Avenue, New York. The Secession holds continuous exhibitions.

RECENT NOVELTIES IN APPARATUS, &c.

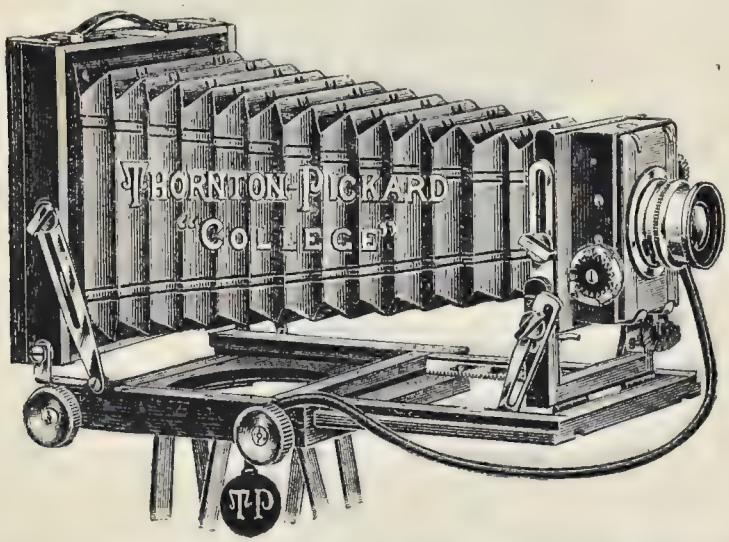
BY THE EDITOR.

[*These notices are confined as far as possible to apparatus introduced since the publication of the last Almanac. In all cases the various articles have come under our personal examination, a rule from which we allow no departure.*]

THE THORNTON-PICKARD COLLEGE SETS.

(Made by the Thornton-Pickard Company, Altrincham.)

In this new series of camera sets the Thornton-Pickard Company have aimed at providing a thoroughly reliable and practical camera at such a moderate price as to be within the means of schoolboys and others, to whom the expenditure of an additional pound or so on an instrument of a more expensive character is a matter of considera tion. The College set is sold at 37s. 6d., in the quarter-plate size



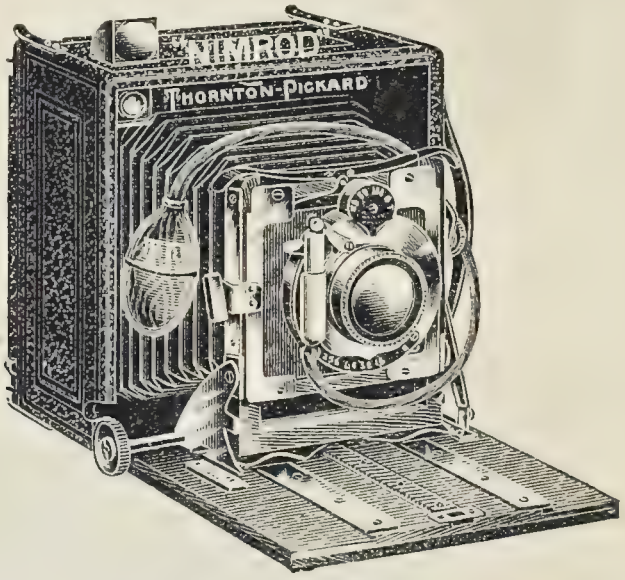
and 50s. in the half-plate size. It is provided with the self-contained erecting front already mentioned in connection with other cameras of the firm, both front and back automatically coming into position square with the baseboard. The camera has swing back and con-

siderable rise of front, with a double extension. It is substantially made throughout, all its parts being brass-bushed in place of the insertion of a metal screw into the wooden portion of the apparatus. It carries the Thornton-Pickard standard roller blind shutter, rapid rectilinear lens, and possesses also the extra extension which it gains from the new strut movement already referred to. The prices given above include also a substantial tripod and one double dark slide.

THE NIMROD AUTOMAN CAMERAS.

(Made by the Thornton-Pickard Company, Altrincham.)

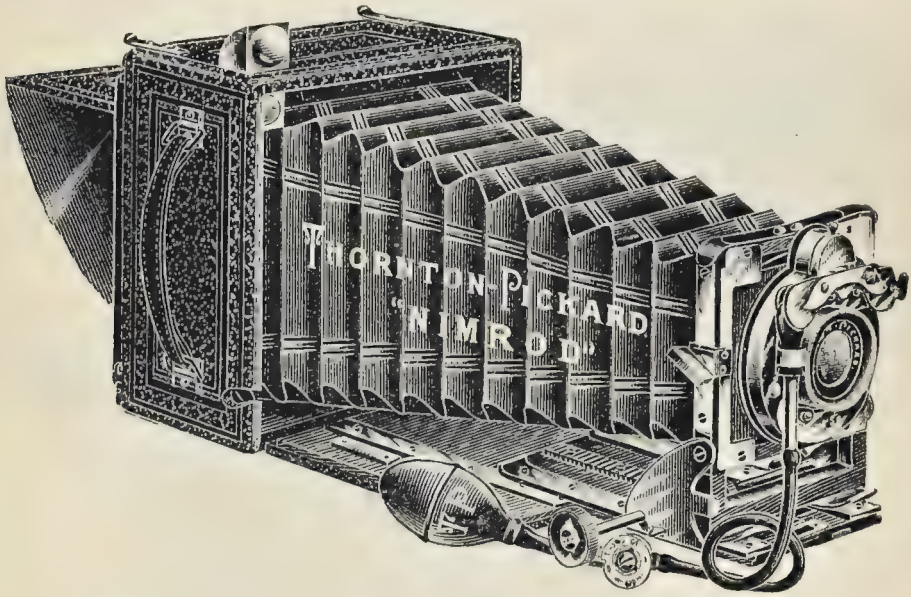
A series of three new cameras, which should be exceedingly popular instruments during the coming season, has been issued by the Thornton-Pickard Company, under the title of the Nimrod Automan, Nos. 1, 2, and 3. All of them have one feature in common—namely, that the front automatically comes into position of focus



for distant objects on the baseboard being pulled down. This movement, which, it will be remembered, was first introduced by the company some three years ago, is now obtained by a much simpler mechanism, with the result that the new cameras are placed upon the market at very moderate prices. The convenience of the movement scarcely requires any emphasis from us. For hand camera work speed of opening the camera is an immense advantage, and we can conceive of no camera which can be more rapidly put into action than one upon the Automan principle. No. 1 of the series is a single extension camera, with reversing back, and rising front, and costs, complete with R.R. lens, shutter, and three double dark slides, only £2 2s. No. 2 of the series is a double extension instrument, permitting the use of the single combination of the lens, with diaphragm shutter, speeded to 1-100 of a second, and with the usual time, bulb,

and instantaneous adjustments. It costs, in the quarter-plate size, £3 10s.

No. 3 of the series possesses the general features of Nos. 1 and 2, but has also a swing back and side swing and short focus movement, permitting a lens of 4 inches focus to be used on the quarter-plate



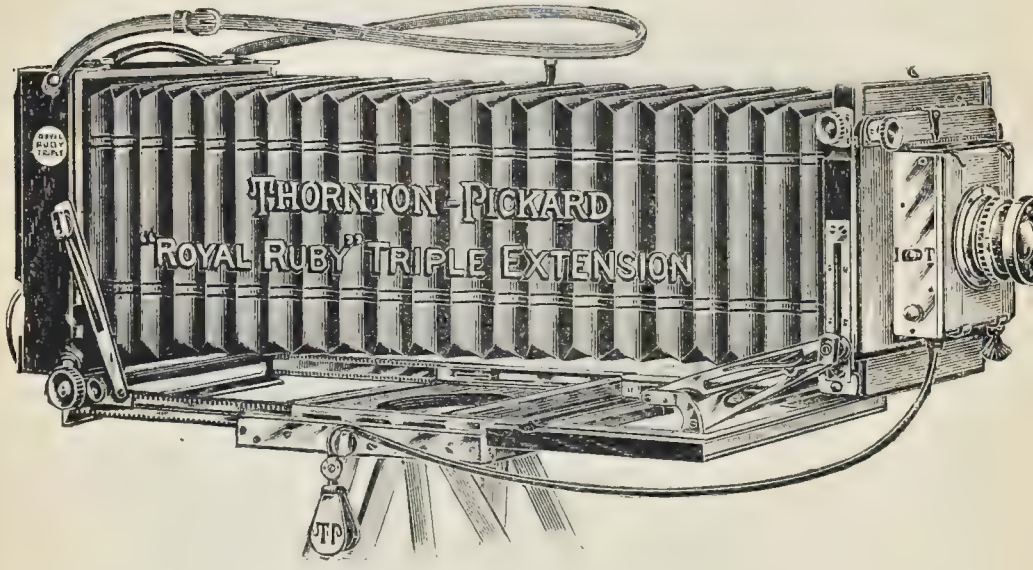
size. The makers fit this camera with their Panoptic shutter, and charge for the outfit, with three pull-out slides, the sum of £5 5s. All three cameras, we may add, are also made in the 5 by 4 size.

THE ROYAL RUBY 1907 CAMERA.

(Made by the Thornton-Pickard Manufacturing Company, Altrincham.)

This universal camera, in regard to previous models of which it might almost have been said that further improvement was impossible, has nevertheless been subjected to revision by the makers, with the result that it now represents an assemblage of photographic facilities which we can hardly believe can be further enhanced. The 1907 model differs from its predecessors chiefly in the method of erecting the camera for work. In previous models of the "Ruby" the front had to be detached from the baseboard, and two studs had to be placed in the sockets belonging to them. By a new arrangement of struts, however, the front is brought into position simply by pulling with one hand; and, what is more, automatically locks itself precisely at right angles to the baseboard. The baseboard itself, we would also say, is locked at right angles to the back of the camera when the instrument is opened. The erected camera, therefore, is immediately obtained in the position which is required for the vast majority of work, and this without any judgment on the part of the user. The mechanism of the front serves other purposes than facility of erection. The front is held by a triangular system

of levers, which have the advantage that the support given by them is of a highly rigid character, due to the base line from which the two sustaining levers spring. The system permits of very great rise of front, and yet at the highest position the lens board is remarkably stable. Further than this, the same lever mechanism



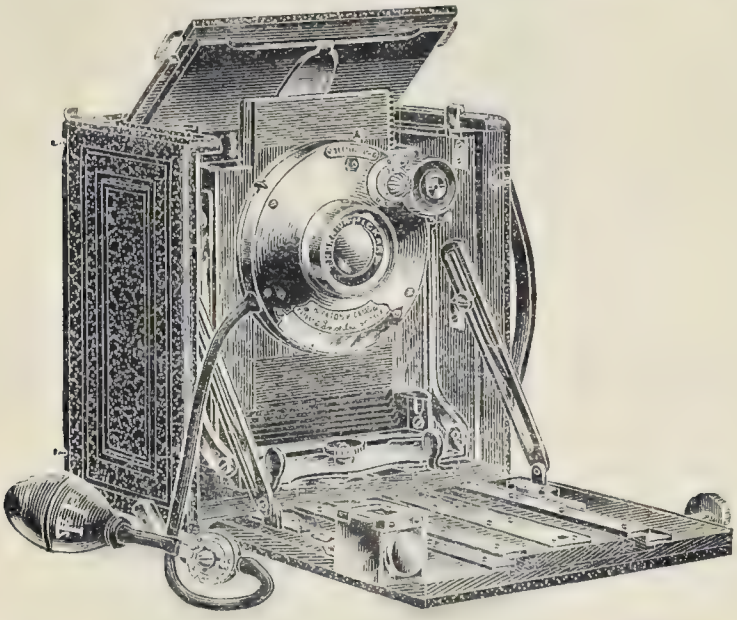
allows the camera front to be depressed downwards towards the plate, so much so as to squeeze the bellows as tightly as can be done between the front and ground glass; or it will enable the front to be drawn forward, aiding the long extension which the racking arrangements of the camera already permit. This new strut mechanism of the company may be said to mark a new era in cameras of their construction. It certainly overcomes an objection which has been made occasionally in the past against the Ruby camera. The total extension in the half-plate size is 22in., or 24in. by taking advantage of the strut movement. In all other respects the camera is well provided. It has the wide angle movement by which the back racks towards the front so as to leave no projecting baseboard in wide-angle work. It carries a bellows, which combines the qualities of a square bellows with the portability of one of taper pattern, for the new strut movement of the front has permitted the makers to adopt a pattern of bellows giving a larger front to the camera and perfectly clear access to the plate even with lenses of a wide angle. Special attention is given by the Thornton-Pickard Company also to the dead-blackness of the bellows inside, a precaution which they have found extremely advisable on the score of obtaining bright negatives. As before, the turntable of the camera is provided with pinion heads which permit of the instrument standing firmly on a table, its focussing screws and other accessories being clear of its support, and thus enabling the user to

employ the camera for copying, enlarging, etc., with great facility. We are afraid no written account can convey an adequate idea of the instrument, but an examination of it will doubtless convince others, as it has convinced us, that it represents the high water-mark of camera construction. The prices remain the same.

THE FOLDING RUBY CAMERAS.

(Made by the Thornton-Pickard Company, Altrincham.)

The Ruby camera is now made by the Thornton-Pickard Company in sizes half-plate and larger. For quarter-plate and 5 by 4 use they offer a new pattern of camera known as the Folding Ruby and of the popular hand-stand variety, which is completely enclosed in its case for carrying. The cameras have the same new strut support



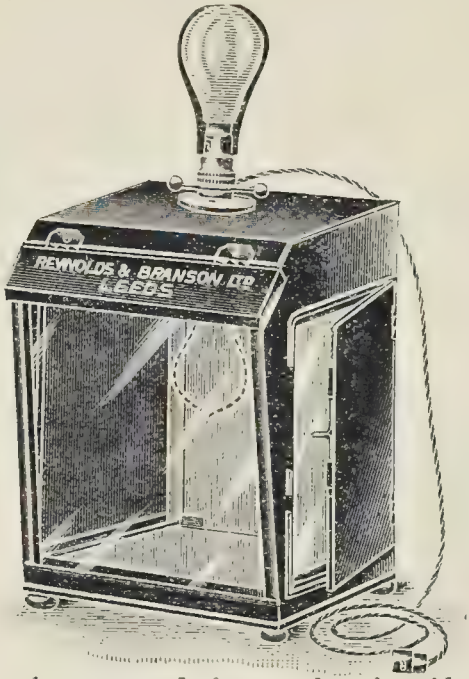
for the front as already noticed in connection with the Royal Ruby. They are fitted with a double rise of front, the whole front itself being raised on its struts, and the panel also giving additional rise. Like the Royal Ruby, also, both front and back automatically lock perpendicular to the baseboard, which latter can be dropped when using the camera in the wide angle position. The camera is fitted with double-focussing scale for the single combination of the complete lens, has a reversing back, and is fitted with the company's Panoptic shutter and Pantoplanat lens.

RYSTOS DARK ROOM LAMPS.

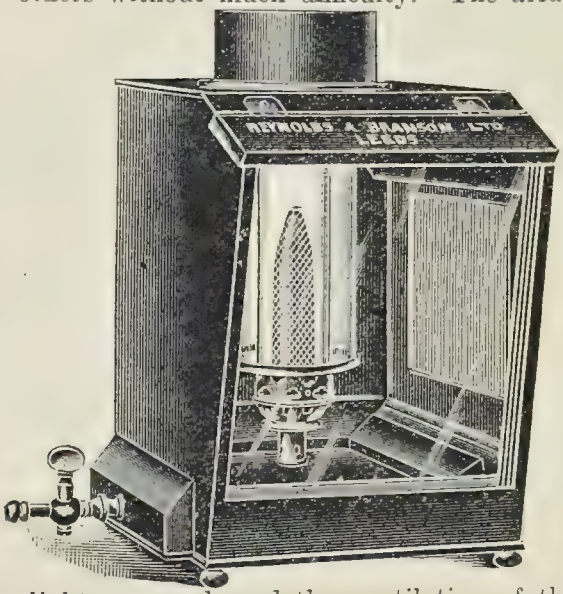
(Sold by Reynolds and Branson, 14, Commercial Street, Leeds.)

The first of these two lamps is for electric light. The body accommodates three glasses, that in the front (removable) measuring

8 x 7 inches. The side glasses are 4½ by 7 inches, and are provided with shutters, as shown on one side in the illustration. Though



not intended to be removed frequently, the side glasses can be replaced by others without much difficulty. The arrangements for



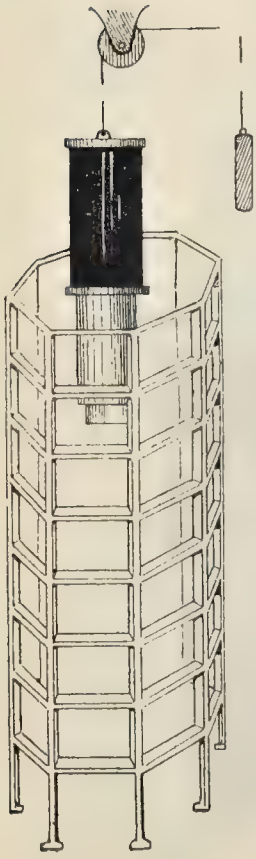
trapping the light are good, and the ventilation of the instrument appears to us to be satisfactory. Above the lamp is mounted an

incandescent burner, in attachment to a switch, which gives red, white light, or total darkness, as may be desired. For printing bromides and for other dark room work this movement, which has been a regular feature of Messrs. Reynolds and Branson's lamps for some years past, should be appreciated. The lamps are supplied for 200-volt circuit. The price for the complete apparatus is one guinea, including 5ft. of flexible connection and two electric incandescent burners.

A similar pattern of lamp, but for incandescent gas, is sold at £1 7s. 6d., and will be understood on reference to the illustration. It is also obtainable with an incandescent spirit lamp for £1 10s.

THE ELECTRIC PRINTING INSTALLATION.

(Sold by Marion and Co., 22-23, Soho Square, London, W.)



In this apparatus Messrs. Marion have aimed at providing the professional photographer and printer with the means of making contact prints on any daylight papers, independently of the weather and as quickly, if not more quickly, than can be done in daylight. The apparatus will be ready for the market by the time that these lines appear, and the accompanying preliminary sketch will make clear the nature of the installation and the facilities which it places at the purchaser's disposal. The source of light is the enclosed arc lamp, as made by the Westminster Engineering Company, a standard instrument already largely used for portraiture. The surrounding framework is designed so that printing frames of various sizes may be employed at one and the same time, although the framing may be purchased to take half-plate or other size without the facility of inserting larger sizes. In using the apparatus, the lamp is occasionally moved higher or lower, in order to supplement the diffusion which takes place without this attention. This has been found as convenient a plan as any, as it enables the printer to finish off quickly any frames which may be lagging behind; it is not necessary to keep the lamp in constant up-and-down motion. The price of the complete apparatus, including lamp, resistances, and framing, will be about £17 or £18.

CENTURY CAMERAS.

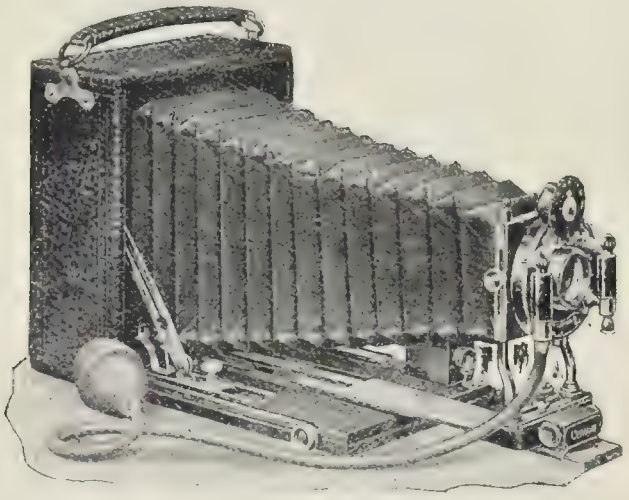
(Sold by Kodak, Ltd., 57 to 61, Clerkenwell Road, London, E.C.)

A series of about a dozen patterns of cameras has been introduced to the British public by the Kodak Company under this title. They possess features of some considerable practical importance, and of a kind also which, we should judge, will be appreciated by the dealer who desires to make the best possible case for the camera to purchasers at the counter. The Century cameras have

Revolving reversing back,
Swing bed,
Focussing screen in automatic register,

and are fitted with finders which can be easily taken to pieces and cleaned. Such are the salient features of the new introductions. Perhaps we can best describe them in reference to two particular instruments, selecting for this purpose the "Petit Century, No. 3," and the "Century Grand Senior."

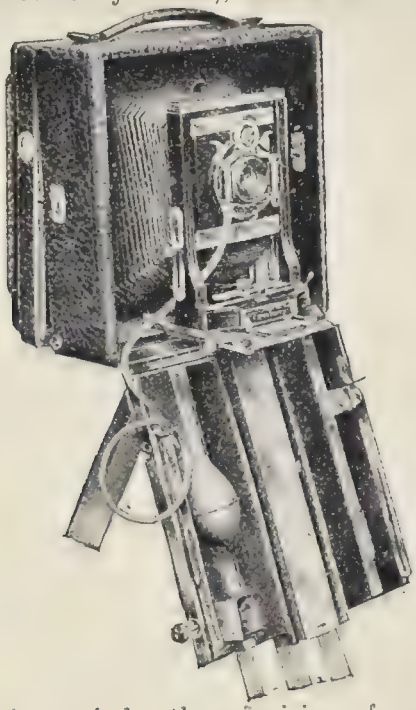
The former is shown in the drawing, from which it will be seen that the cameras are of the hand-stand pattern, the particular one



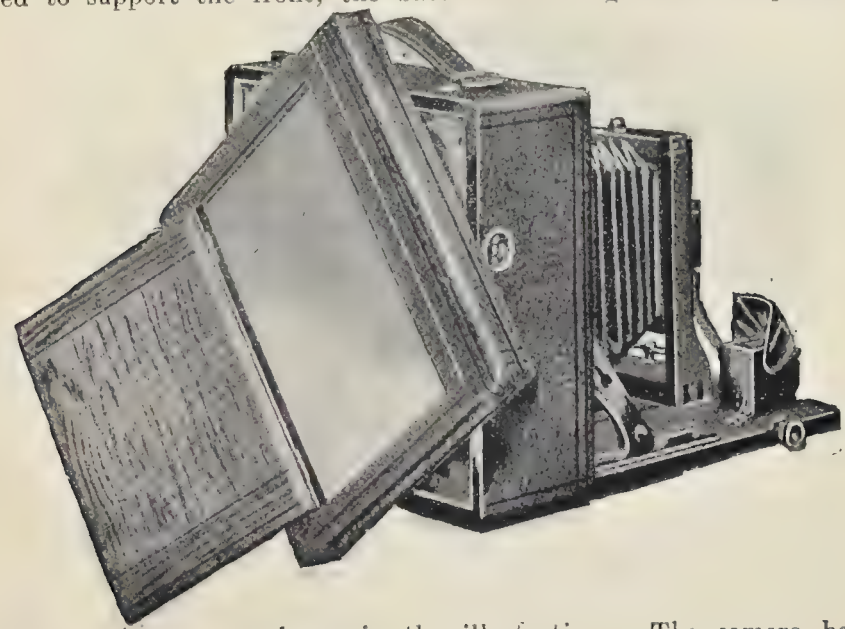
of the series being with double extension, fitted with automatic clamp for the lens front, by which the focus is fixed in an instant, and the front released with equal ease and rapidity. The front has rising and cross movements, in both cases actuated by rack and pinion. It carries automatic shutter, reversible finder, and is in appearance as good-looking an instrument, as we consider it to be well equipped for practical work. The prices are: £3 18s. in quarter-plate, £4 15s. in 5 by 4, in each case including one double dark slide.

In the "Grand Senior" model, all the most varied requirements

of the photographer have been studied. The camera is of triple extension (16½ inches—5 by 4 size), and is also fitted for the very



shortest wide angle work by the provision of an extra detachable bed to support the front, the baseboard falling down completely



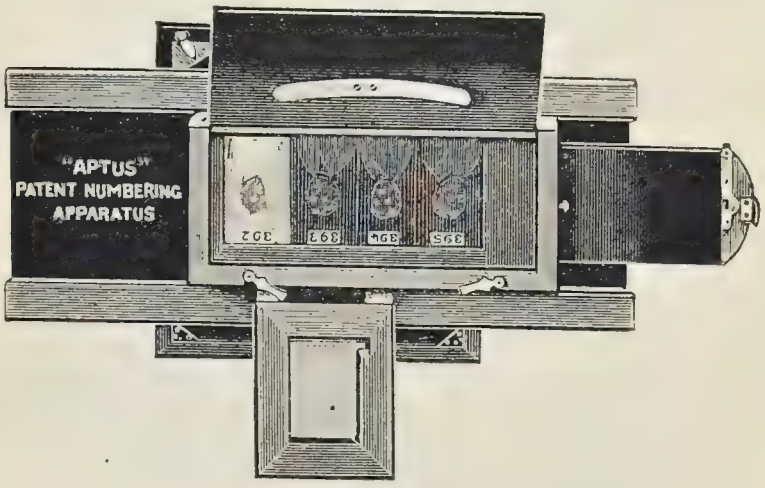
out of the way, as shown in the illustration. The camera has swing front of the usual pattern, but for this wide angle position

an additional swing is provided. All the other usual movements, such as rise and cross movement of front, are available, and, for the price of £11 in the 5 by 4 size, the camera is fitted with superior R.R. "Centar" lens. The price in 7 by 5 is £13, and in 8½ by 6½, £16 15s.

THE "APTUS" NUMBERING SYSTEM FOR MIDGET PHOTOGRAPHY.

(Made by Sharp and Hitchmough, 101-103, Dale Street, Liverpool.)

The system of numbering each negative in making a series on one large plate has passed through several forms in the hands of Messrs. Sharp and Hitchmough, until its arrival in the convenient shape in which it is embodied in the present apparatus. One form which was, and is still, employed consists in a frame, bearing a number at its lower extremity, which is suspended behind the sitter, so that the figures appear at the upper edge of the negative. This position is adjusted by a balancing weight which the operator moves whilst focussing the sitter. Such a system, though valuable, is less satisfactory than one in which the numbering device is concealed from view in the camera itself, and the new system permits of this being done by the interposition of a stencilled number on cardboard in front of the plate. The numbered ticket is slipped in grooves, and is brought into register by the act of withdrawing the dark-slide shutter, the numerical series being recorded on the plate without the attention of the operator. The simple exposure, therefore, in the ordinary way prints upon the negative the number corresponding to the sitter, and Messrs. Sharp and Hitchmough supply the series of numbers either in paper at 4s. per thousand, or in perforated brass



at 15s. per hundred; the latter being, of course, quite durable and not liable to being torn off during the use of the apparatus. The two drawings will show the use of the apparatus, the price of which (camera and one single slide) is £4 4s.; extra single slides 8s. 6d., or double 12s. 6d. The price of the numbering attachment is £1 1s.

THE "FOLDEX" CAMERA.

(Sold by the City Sale and Exchange, 93, 94, Fleet Street, London, E.C.)

The "Foldex" is a very portable, long-extension camera of the hand-stand variety. It is made in the quarter-plate and half-plate sizes only, the extension of the latter from plate to lens slot being 14½in. The camera has a novel rising front movement worked by a rack and pinion, as shown in the figure. It has also a winch movement for the cross-front.

The camera is double-scaled for use with the single component of the lens, and carries a special form of infinity catch, which is instantly thrown out of action when photographing nearer objects. The outfit is obtainable with a Clement and Gilmer specially rapid Aplanat working at *f*/8, and may be had with either the "new compound" or "Koilos" shutter. With three double dark-slides of light metal the price is £5 17s. 6d. in the quarter-plate size, and in the half-plate size £7 10s. The camera, from its compactness—when closed it measures only 8in. square and 2in. thick in the half-plate size—should be very popular.

(Continued on page 859.)

INDEX TO NOVELTIES.

Acetylene jet, Moss, 862
,, generator, Moss, 902
Camera, "Alpine," Voigtlander, 904
,, Century, 612
,, "Chic" pocket, 880
,, ferrotype, "Taquta," 875
,, focal-plane, "Deft," 879
,, ,, "Elite," 871
,, folding "Foldex," 615
,, ,, Kodak No. 4A, 876
,, "Free-film," 881
,, half-plate and stereo Salex, 892
,, "Idento," hand, 943
,, long extension, "Ilex," 901
,, pocket, "Ariel," 882
,, pocket "Gem" and "Imperial," 889
,, pocket "Salex," 883
,, portable Postcard, 910
,, "Premoette," 882
,, "Quick-focus" Kodak, 872
,, reflex "Challenge de Luxe," 866
,, ,, "Graflex," 877
,, ,, lantern size, 892
,, ,, "Planoreflex," 887
,, ,, "Planex," 895
,, ,, Voigtlander, 874
,, sets, Thornton-Pickard "College," 605
,, stereo-panoramic Voigtlander, 904
,, Studio Marion, 871
,, "Telecam" and "Pockam," 864
,, "Tele-partition," 945
,, Thornton-Pickard "Folding Ruby," 609
Camera, Thornton-Pickard "Nimrod," 606
,, ,, ,, "Royal "Ruby," 607
,, "Ticka," 905
,, twin-lens reflex Ross, 860
Cinematograph "Perfect" projector, 941
Clock "Welborne-Piper," 947
Dark-room lamp, "Geka," 867
,, ,, "Rubralux," 865
,, ,, Rystos, 609
Developing tank, Kodak, 869
Dishes, Steel C.X.R., 897
Dry-mounting machine, 906
Enlarging and printing easel, 863
,, camera "Daornyta," 891
,, lamp "Ellipsoid," 893
Exposure Meter, "Ilford," 941
Eye-pieces for reflex cameras, 877
Ferrotype camera, 875, 892
Files "Negasys," 888
Film changer "Zambex," 900
,, ,, Ross, 859
,, squeegee "Primus," 893
Flash-light shade "Aptus," 886
Focussing screens ruled, 881
Holostigmat f/4·6, 884
Lantern electric Archer, 859
,, "Excelsior No. 10," 885
,, screen folding "Aptus," 864
,, -slide cleaning frame, 888
,, ,, heating case, 880
Lens anastigmat Aldis, 861
,, "Anastigmat Rectigraph," 863
,, Holostigmat, 884

Lens, "Planastigmat" New, 943
,, studio Beck *f*/3, 860
Light incandescent "Alko," 886
Measure black-line, 879
,, bottle and funnel combined, 896
Mercury-vapour printing lamps, "Sickle," 944
Midget photography numbering system, 614
Mounting machine, Dry, 906
Numbering system for midget photography, 614
Post-card Printing frame, "Nonask," 868
,, registering frame, 895
Printer, bromide, Renaud, 897
,, ,, "Aptus," 868
Printer, bromide, Hana, 946
Printing frame, "Togo," 869
,, installation, Marion, 611
Prism, "Actinolux," 890
Repeating back "Altrincham," 862
,, ,, "Soho," 939
,, ,, "Autodel," 893
Shutter, Beck "Celverex," 899
,, Busch "Skyshade," 884
,, Packard "Ideal," 903
,, roller-blind, "Altrincham," 866
Telephoto attachments, "Beck," 943
,, lens, "Bistelar," 869
,, ,, "Junior Adon," 870
Washer, "Circu," 880
,, "Undercurrent," 873
Wide angle lens sets, 874
"Zambex" skeletons, 909

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GRADE: NATURAL SURFACE.

THE BRITISH JOURNAL

PHOTOGRAPHIC ALMANAC

AND

Photographer's Daily Companion

FOR

1907.

EDITED BY GEORGE E. BROWN, F.I.C.

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PREFACE.

THE present issue of the ALMANAC appropriates considerably more space for the section "Epitome of Progress," than did that of last year. I am glad to learn from a number of readers that this classified arrangement of the subject matter adopted in the "Epitome" has added to the usefulness of the volume, by bringing everything on one subject into one place. A glance at the contents should permit of any given item being found at once, but a full index has nevertheless been provided.

I have to thank several readers in distant parts of the world for photographs of themselves in the act of consulting the ALMANAC, and, in one instance, in company with the volumes for many years past. It need scarcely be said that these marks of approval have been received with pleasure, and I shall be glad to acknowledge gratefully any others which may be sent to me.

It only remains to thank all those who, by their contributions, their suggestions, and in other ways, have assisted the publication of an ALMANAC, which again is larger, and, it is hoped, more valuable than any of its predecessors: and to offer them, in the interval before the appearance of its successor, any assistance which may be possible through "The British Journal of Photography."

GEORGE E. BROWN,
Editor.

24, Wellington Street, Strand, London, W.C.
November 1, 1906.

CONTENTS.

Index, p. 1131.

Index to Advertisers, p. 1231.

PAGE

CALENDAR 531

DIRECTORY OF PHOTOGRAPHIC SOCIETIES.

Royal Photographic Society 555
Societies of the United Kingdom 556
Postal Clubs 586
Colonial Photographic Societies 583

PHOTOGRAPHIC BODIES 598
The Professional Photographers' Association 593
The Professional Photographers' Society of New York 594
The Photographic Convention of the United Kingdom... 594
The Copyright Union 595
The Artistic Copyright Society 596
The National Photographic Record Association 597
Photographic Survey Associations... 597
The Linked Ring 598
The Affiliation of Photographic Societies... 598
The Scottish Photographic Federation 601
The Yorkshire Photographic Union 602
The Lancashire and Cheshire Photographic Union ... 603
The Northumberland and Durham Federation of Photographic Societies 604
The American Federation of Photographic Societies ... 604
The Photo-Secession... 604

OBITUARY 625

THREE-COLOUR PHOTOGRAPHIC PRINTING PROCESSES. By the Editor 628

CONTRIBUTED ARTICLES 650

EPITOME OF PROGRESS.

I.—GENERAL.
Events of the Year: Copyright: Business: History ... 638

II.—APPARATUS AND EQUIPMENT.
The Dark Room and Studio 693
Lenses and Photographic Optics: Optical Glass, Properties of Lenses, Lenses in Practice 702
Telephoto Lenses 711
Lens Testing and Measurement 712
Cameras and Accessories 713
Instantaneous Shutters 715

II.—APPARATUS AND EQUIPMENT (*continued*). PAGE

Artificial Light: Enclosed Arc Lamps, Magnesium Light 716
Materials: Raw Paper, Tests of Paper 720

III.—PHOTOGRAPHING VARIOUS SUBJECTS.

Portraiture, Landscape 721
Copying 727
Stereoscopic Photography 780
Pinhole Photography 784

IV.—NEGATIVE PROCESSES.

Gelatino-bromide: Backings, Emulsions 784
Orthochromatic Processes: Sensitisers, Light-filters ... 741
Development: Developers, Time Development, Stand Development, and Methods, Defects, &c., in Development 749
Self-developing Plates 754
Fixing and Hypo-eliminators 758
Intensification of Negatives 760
Reduction of Negatives 761
Varnishes 762
Retouching Negatives 763

V.—PRINTING PROCESSES.

Positives Direct 766
Printing Methods and Accessories... 768
Gelatine and Collodion P.O.P.; Emulsions, Toning, Developing 773
Self-toning Papers 785
Bromide and Gaslight Papers: Warm Tones by Development, Toning Bromides 789
The Carbon Process 799
Ozobrome 802
Gum-bichromate: Multiple Gum 805
Oil-printing 809
Platinum Printing 810
Iron Printing Processes: Ferro-prussiate, Copying Tracings 812
Catatype Printing Processes 814
Miscellaneous Processes and Prints on Various Supports 816
Mountants and Mounting 818
Enlarging 819
Working up and Colouring Prints and Enlargements 823
Lantern Slides, Cinematography... 825

VI.—Colour Photography.
Direct Interferences Processes (Lippmann) 828
Bleach-out Processes 829
Three-colour Processes—Apparatus, Plates, Filters, and Sensitisers 832
Transparencies by the Indirect Three-colour Process ... 840
Three-colour Processes on Paper 843
The Diffraction Process 845
One-plate Three-colour Processes 849
Two and Four-colour Processes 852
Colour Effect from Ordinary Negatives 854
List of English and Foreign Photographic and Allied Journals 855
RECENT NOVELTIES IN APPARATUS ... ... 605 and 864
Index, p. 616.

FORMULÆ FOR THE PRINCIPAL PHOTOGRAPHIC PROCESSES.

	PAGE		PAGE
Developers	950	Albumen Paper	980
Fixing Baths	963	Gelatine P.O.P.... ...	981
Hardening and Clearing Solutions	965	Collodion P.O.P. ...	985
Intensifiers	966	Bromide and Gaslight Papers	986
Reducers	969	Carbon Process	990
Varnishes	970	Platinum Printing ...	991
Stripping	972	Ferro-prussiate, etc. ...	992
Orthochromatic Processes	973	Mounting Prints ...	993
Wet Collodion and Collodion Emulsion ...	975	Spotting, Colouring, etc., Prints	995
Plain Paper	979	Miscellaneous Formulæ	996

DEVELOPING FORMULÆ, ETC., OF THE PRINCIPAL PLATE AND PAPERMAKERS.

	PAGE		PAGE
Austin Edwards... ...	1000	Lumière, N. A., Co., Ltd.	1035
Bayer Co., Ltd.	1001	Marion & Co., Ltd. ...	1037
Cadett & Neall, Ltd. ...	1001	Mattos, Ltd.	1043
Edwards, B. J., & Co. ...	1005	Mawson & Swan ...	1044
Elliott & Sons, Ltd. ...	1006	Ozotype Company ...	1047
Gem Dry Plate Co., Ltd.	1009	Paget Prize Plate Co., Ltd.	1048
Griffin, John J., & Sons, Ltd.	1010	Photolinol, Ltd. ...	1055
Ilford Limited	1014	Rajar, Ltd.	1055
Illingworth, Thos., & Co, Ltd.	1020	Rotary Photographic Co., Ltd.	1057
Imperial Dry Plate Co., Ltd.	1022	Rouch	1060
Kodak Limited	1025	Thomas, R.W., & Co., Ltd.	1061
Leto Photo Materials Co., Ltd.	1032	Wellington & Ward ...	1062
		Wratten & Wainwright	1068
		Zimmermann, Chas. & Co.	1069

MISCELLANEOUS INFORMATION.

	PAGE
A List of the Principal Text-Books on Photography ...	1071
The Copyright Act	1074
Reproduction Fees	1079
The Poisons Act	1080
The Patents Act	1080
Insurance Companies and Exhibitions of Animated Photography	1083

TABLES.

Weights and Measures	1084
Diaphragms Standards	1093
Atomic Weights of the Elements	1094
Symbols and Equivalent Weights of the Principal Substances used in Photography	1096
Solubilities of the Principal Substances used in Photography	1102
Densities of Ammonia Solutions	1108
Solubility of the Silver Haloids	1109
Thermometric Tables and Rules	1110
Distribution of the Colours in the Spectrum	1111
Wave-lengths of Bright Lines of Elements used in Plotting out the Spectrum	1112
Properties of Orthochromatic Plates	1115
Freezing Mixtures	1116
Relative Exposures	1116
Exposures for Moving Objects	1118
Poisons and their Antidotes	1119
Equations relating to Foci	1120
Approximate Infinity for Lenses of various Focal Lengths	1121
Tables for Enlargements	1122
Relative Exposures for Varying Proportions of Image to the Original...	1123
Angles of View	1125
Distances for Lantern Projection	1126
Continental Stops and their Equivalents...	1127
Distances for an Object of 68 inches height... ...	1128
Tables of Distances at or beyond which all objects are in focus	1130

OBITUARY OF THE YEAR.

Among those whose deaths have taken place since the publication of the 1906 Almanac are:—

F. Maxwell Lyte (March 4, 1906).
A. H. Wall (June 24, 1906).
Leon Vidal (Aug. 5, 1906).
Colonel J. Gale (Aug. 6, 1906.)
J. Guardia (June 25, 1906).
William Grove (April 30, 1906).
G. H. Judd (Dec. 15, 1905).
H. Schnauss (Mar. 14, 1906).

F. Maxwell Lyte.

The death of Farnham Maxwell Lyte deprives photography of one of its early workers, though his active connection with photography lasted only about sixteen years—from 1854 to 1870. His most notable achievement in photographic progress was, however, the invention of the so-called "honey" process, by which the wet collodion plate could be retained in workable condition for several days. This process he published in "Notes and Queries" for June 17, 1854, his letter appearing a fortnight after George Shadbolt, a formed editor of The British Journal of Photography, had independently communicated an identical process to the Photographic Society (now the Royal Photographic Society). Mr. Lyte was also one of the first to point out the danger to photographs of "antichlor" impurities in mounts. He was the originator of the present borax and phosphate toning baths and the introducer of iodide into collodion emulsion for better colour rendering.

Mr. Lyte was a chemical engineer and an Associate of the Institution of Civil Engineers, and an honorary member of the Royal Photographic Society. He was one of the oldest members of the Chemical Society, and an original member of the Society of Chemical Industry. His father, the Rev. Henry Francis Lyte, may be remembered as the author of the well-known hymn, "Abide With Me."

A. H. Wall.

Though known to many of the older generation of photographers, Mr. Wall had outlived his relations with photography. For the following notes of his career I am indebted to one of his most intimate friends (Mr. Snowden Ward).

Mr. Wall was born in London; his early youth was spoiled by an unsympathetic step-father, and, running away from home, he first joined one of the early Daguerreotypists and soon afterwards "went on" as a super in the company of the great Macready. In 1850 Mr. Wall began business with a partner in Cheapside, London, as miniature painters and Daguerreotypists. The miniature was

killed by the Daguerreotype. In 1851 Mr. Wall was assistant to a photographer working near the Great Exhibition, and later opened a studio in the Strand as miniaturist and portrait painter—a complete failure. In 1852 he married and set out with his bride as a touring portrait painter, with fair success. He used the name of R. A. Seymour, and in the "Photographic News" for 1861 will be found the story of his tour. The early death of his wife sent him back to the stage.

For Hazell, Watson, and Viney Mr. Wall edited "The Illustrated Photographer" during 1868, '69, and '70, a magazine that was before its time; and since then his connection with photography has been limited to occasional contributions and criticism. In earlier years he was a regular contributor to the BRITISH JOURNAL. He founded the old South London Photographic Society, and was one of the founders and most active members of the Solar Club. The later years of his life were spent in the congenial position of Curator of the Shakespeare Memorial Library at Stratford-on-Avon.

LEON VIDAL.

M. Vidal's parents were proprietors of the salt works at Port de Bouc, near Marseilles. He was educated as an engineer at the Lycée, St. Louis, but preferred the laboratories of the Sorbonne, becoming preparator to Dumas and Claude Bernard. In the summer he superintended the salt collection at his home, and made over the mother liquors, saturated with iodine and bromine, to Poitevin, There can be little doubt that from this intimacy with Poitevin who was then director and chemist of a neighbouring salt factory. he was led to identify himself with the practical development of the photo-mechanical methods.

After the death of Poitevin his family confided to M. Vidal the publication of his photographic work, and the result was a new edition, in 1883, of the "Traité des Impressions Photographiques," revised and enriched with valuable notes and appendices.

In 1879 he took over the direction of the "Moniteur de la Photographie," and ably edited it for many years. He worked out the polychrome method of colour printing, founded on the Woodbury process, but, like it, now superseded by simpler methods. It was, however, very suitable for the purposes intended of reproduction of jewellery, fine fabrics, porcelains, etc., with their colours and metallic lustre. Under his direction also some very fine albums of reproductions in collotype were brought out.

He was a Chevalier of the Legion of Honour, Officer of Public Instruction, and since 1879 was Professor at the Schools of Decorative Arts in Paris and Limoges, and delivered regular courses of lectures on processes of photographic reproduction.

In 1889 M. Vidal started a society for mutual assistance, L'Union Photographique; later, the Société des Photographies Documentaires, and four years ago he promoted the Société de Photochromie. He was latterly particularly interested in the development of colour photography, and constantly working at it. A man of most kindly and generous nature, he had many friends in all parts of the world, and was always ready to help them in furthering the cause he had so much at heart.

J. Guardia.

Mr. Guardia was a Spaniard by birth, but had been a naturalised Englishman for more than 25 years. His photographic career at its commencement, twenty-five years ago, was marked by his thorough advocacy of the hand camera as capable of everything which might be desired in photography, and infinitely the superior of the stand camera, from the tourist's standpoint. His own ideas at that time in camera construction brought him into relations with Mr. A. S. Newman, also a photographer and mechanician of the highest order, and one, too, able to adapt his grasp of mechanical construction to the many refinements which go to make the perfect camera. The two men associated themselves in partnership about seventeen years ago, and developed the well-known business bearing their names.

William Grove.

In the death of Mr. Grove, the surviving partner of the firm of Window and Grove, Baker Street, London, the Professional Photographers' Association lost its secretary and treasurer. Mr. Grove had also acted as treasurer of the Copyright Union since its formation.

G. H. Judd.

Mr. Judd was first foreman, then manager, and, in the later years of his life, secretary for the firm of J. H. Dallmeyer, Ltd. He took an active part in promoting the interests of the London Orphan Asylum and similar institutions.

Hermann Schnauss.

Herr Schnauss was editor of "Apollo" at the time of his death, having commenced a career of photographic journalism with the firm of Liesegang of Düsseldorf as co-editor of "Photographisches Archiv.," and as editor of "Der Amateur Photograph." He was the author of a number of handbooks on photographic subjects.

THREE-COLOUR PHOTOGRAPHIC PRINTING PROCESSES.

By the Editor.

INTRODUCTORY.

In choosing the subject for the introductory article to the present Almanac I must confess to some doubt as to whether the present is precisely the time at which to bring together in convenient form the photographic methods available for the making of paper prints from sets of three-colour negatives. I may be told that it is early in the day to bring such methods to the forefront of notice, as challenging the attention of the majority of photographers, or it may be said that the days of trichromy by the method of assembling three separate prints or images have already had their quietus given them in the advent of the "single print" processes, of which the Lumière starch grain method represents the making of the negative, and the Smith "bleach-out" tissue the printing therefrom. As I am, according to the two views, at once too early and too late, it is just possible that I am not far out of my chronological bearings after all. I am encouraged to think that such is the case, from the fact that never before has so much interest been shown in colour photography on paper as during the year (1906) which has now elapsed. Some public interest was aroused by the colour prints at the exhibition at the British Journal of Photography, and the year has also witnessed the first commercial exploitation of colour photography in professional portraiture, and the creation of a feeling among photographers, both amateur and professional, that the arrival of colour photography is not to be long delayed.

Of the attractions which photographic prints in the colours of nature offer to the amateur, the pure pictorialist or even the less assertive "taker of views," there is no need to speak. The photographer who uses the camera to earn his living will regard the new branch of the art from the point of view of profit, and in that direction there is not much evidence to encourage or deter him. A good deal is said about the utter impracticability of the trichrome processes, from the commercial standpoint, but it is forgotten that the actual making of three-colour prints by the carbon, or imbibition process, such as the Sanger-Shepherd or Pinatype, need not be costly,

worked on a fairly large commercial scale. The materials are inexpensive, and the labour, under skilled direction, might be of the cheapest. For three-colour portraiture in an occasional way, at a high price, there does not appear to be great possibilities of profit, but encouragement should be found in the growing preference for colour on the part of the public to discern in colour portraiture as a regular thing the means of attracting business, which, it is conceivable, could be made highly profitable.

THE BASIS OF THREE-COLOUR PRINTING.

If I were to preface this article with an adequate discussion of the views entertained and expressed of three-colour photography, I am afraid I should never reach the subject-matter proper at all, and I must confine myself to the bare statement that the basis of all the processes which are here described is the employment of a colour for each component of the trichromatic print complementary to that of the colour recorded in the negative from which it is made. This so-called "subtractive synthesis" is no new departure in colour photography, for it was suggested by Du Hauron in his "Les Couleurs en Photographie," published by the firm of Marion, in Paris, in 1869; but it is only within the last year or two that processes have been available by means of which Du Hauron's principle could be applied by those not possessing unusual skill.

With the exception of the "bleach-out" process, which stands by itself, all the processes which follow depend upon printing from the set of three-colour negatives as follows:—

From the blue-screen negative in yellow.

From the green-screen negative in pink.

From the red-screen negative in greenish-blue.

The colours obtainable for this purpose are still far from perfect, and it is surprising that their departures from theoretical requirements permit of the production of such excellent results as have already been obtained. But there is no doubt that the next year or two will see considerable advances in this respect, and that the photographer working any of the processes which follow will have far more perfect materials at his disposal.

In what follows I have not attempted to give every process which has been used for three-colour printing. To do so would fill a very large portion of this volume, and the result would be of little value to the reader. Instead, I have selected only those processes which at the present time have proved themselves capable of adoption. Specimens of almost every one of the processes here described were shown at the exhibition of colour photography, held at the BRITISH JOURNAL OF PHOTOGRAPHY, in January and February last.

CARBON FILMS ("ROTARY" PIGMENT FILMS).

Under the name of "stripping pigment films" the Rotary Photographic Company supply thin celluloid sheets coated with a bichromated pigmented gelatine. Though first introduced for monochrome

printing, it was not long before the Company saw the special adaptability of the process to three-colour work, and they have now a set of films for the red, blue, and yellow images, in addition to filters for the making of the negatives. It is not within the scope of this article to deal with these latter or to discuss their relation to the colours of the pigment. But the process itself has shown itself capable of such admirable results that I may recommend it to the special attention of three-colour workers.

The pigment films dispense with transfer from the circumstance that the printing is done through the celluloid—the celluloid face is laid in contact with the negative—and the film immediately developed.

The developed pigment images, still adhering to the celluloid, are dried, and one by one transferred to a piece of single transfer paper, which serves as the final support. A great advantage of the process is the fact that while still wet with the developing water, the pigment prints can be laid one on the other on a piece of opal and the print seen in its colours. An allowance is necessary for the cooling which takes place in drying, but it is one which is readily made after practice, and the facility of judging what the final result will be whilst the prints are still in condition to be developed further is no slight one in commercial work where very frequently an absolutely truthful reproduction of the subject is of less importance than a pleasing picture.

Sensitising and Drying.

The films are purchased in an insensitive state, and are sensitised, like carbon tissue, by one minute's immersion in a bichromate solution. The strength of the latter may be varied as in carbon work, being made stronger for hard negatives and weaker for flat ones, but the following may be taken as a formula suited to the rather soft negative which should be the rule in three-colour work:—

Potass. bichromate	1 oz.
Water	30 ozs.
Ammonia (.880)	1 drachm.

This is roughly 3 per cent.; it may be 4 per cent. for stronger, and 1 per cent. or 2 per cent. for weaker negatives. The quantity of ammonia given should suffice if the latter is of full strength, but more may be needed if the supply is not up to strength or if the bichromate is extra acid. In any case, the solution should distinctly turn red litmus paper blue. A defect in this respect will render the film difficult to develop.

The bath should be used at 60 deg. Fahr., not warmer, and be kept in the dark after use.

After immersion the film is laid between filter-paper for a moment and the superfluous solution absorbed by passing the hand over the paper. Each film is then pinned down at each corner to a piece of card and dried in the dark in a warm, well-ventilated room. Three or four hours is usually sufficient for the drying of the thinly coated films.

It may sometimes happen that the gelatine coating strips off from the celluloid. The cause is too rapid drying. If the drying condi-

tions cannot be remedied, 1 per cent. of glycerine added to the sensitising bath will prevent recurrence of the trouble.

Before placing the film in the frame to print care must be taken to wipe the celluloid surface free of any patches of bichromate crystal, for, as the celluloid goes in contact with the negative, any such defects will appear in the print. In cleaning the backs do not forget that the celluloid is easily "kinked," and requires wiping by strokes all in the same direction.

Printing and Development.

Printing is done by actinometer, any type of which may be used. The Rotary Company recommend a multiple tint instrument, but those who prefer to work by single tint can do so by this process. As to the absolute and the relative times of exposure, no hard and fast rule can be given. The blue will print quickest, next the yellow, and then the red, but the relative times to give each can only be found by trial, although much can be done, as in ordinary carbon work, to remedy excessive exposure by colder developing water, and under-exposure by hotter water and immersion in a weak caustic soda bath for a few minutes.

The film is immediately developed (no transfer) by first soaking in cold water for about five minutes before placing in the warm water. Care is needed to keep this cooler than is usual or safe with paper tissue. A temperature of 85 deg. or 95 deg. Fahr. may be considered normal for our purpose: at higher temperatures the celluloid tends to soften—which means deformation and want of register—but there is no need to be greatly apprehensive on this score, for the film seems to stand water at 110deg. and warmer with equanimity. Yet it is, as I have said, better to work it at the lower temperatures. In developing the tissue the high-lights should clear completely, and the half-tones be full of detail, the print being, of course, pale in comparison with an ordinary monochrome print.

The three prints having reached a stage of approximately complete development, the result is examined by laying them wet—first yellow, then blue and red—on a piece of white opal, the yellow, if necessary, being clipped in position to prevent it sliding about. A fairly good, though not a perfectly accurate, approach to the appearance of the final print is thus obtained.

If not satisfactory, the print may be further developed with a view to improving the colour-rendering or lightening the print as a whole. This course is taken in making the first print; if many duplicates are required it will probably be found best to prepare, first, a set of the three monochromes which, without actual transfer to the final support, are judged to be satisfactory, and to give these to the printers to work by. One or two extra prints may be done of each colour, and the various sets made up from these to the best advantage.

The single films are pinned up to dry, and here a word of caution is necessary. The films should be simply pinned up by the corner, not clipped up or caused to hang straight by being weighted, as is commonly done by users of negative roll films. The avoidance of distortion of the films is the object of this precaution.

Assembling the Three Monochromes by Stripping.

The paper for the final support of the print is sold as "tri-colour mounting paper," being a special smooth white paper, exhibiting such small differences in expansion when wetted that the three separate images can be successively transferred to it without loss of register. Experience certainly proves that the paper is satisfactory in this respect.

The instructions for the transference of the prints are as follows:—The yellow print is softened by a quarter of an hour's soak in water at 80 deg. Fahr., and when this has been done, the mounting paper is softened in water at 65 deg. Fahr. for not longer than one minute at the most. The print is then brought into contact with the adhesive side of the paper whilst under water, air bubbles being carefully removed. The two are removed together, and laid, paper underneath, on a smooth support covered with a few thicknesses of filter-paper. A sheet of filter-paper, or, better, a thin piece of celluloid, is laid over them, and they are now gently rubbed into contact with a towel. They are then placed for a quarter of an hour under slight pressure—between two glass plates, held together by clips—and then hung up in the air to dry. Any hastening of the drying, and especially by heat, is to be avoided, as the gelatine of the print is hereby too completely dried, and the mounting paper in most cases will not expand as before in water. Moreover, too rapid drying renders it difficult to strip off the celluloid.

When the yellow print is dry, the celluloid base is stripped off, and the image rubbed over with a little benzole on cotton wool.

The transfer of the blue print is done in much the same manner, the print being softened for a quarter of an hour in water at 80 deg. Fahr., and the paper bearing the yellow print being soaked in water at 65 deg. Fahr., until it straightens out (in no case for longer). The blue print can be transferred to the yellow image by simple application and pressure without any intermediate means, but the following method is, however, recommended, for the reason that particles of rubber may be left on the print, when the celluloid is stripped off, and interfere with the perfect adhesion of the second print.

The softened paper print is laid, still wet, on a glass plate, covered with filter-paper, and sufficient of a thin solution of gelatine and chrome alum poured over it to completely cover it. The film print is then applied, a sheet of celluloid laid over it, and the whole rubbed down with a towel, so as to expel the excess of gelatine solution. The two images are now quickly placed in register by moving the blue print about, a final rub down is given, and the whole then placed under slight pressure for a quarter of an hour in a press or between two clipped glass plates. It is then hung up to dry, the celluloid stripped off, and the double print (yellow-blue) rubbed over with benzole as before.

The chrome alum and gelatine solution is:—

Ordinary gelatine	150 grs.
Warm water	30 ozs.

After complete solution add:—

Chrome alum (10 per cent. sol.)	¾ oz.

stirring well and filtering.

The red print is transferred in precisely the same way, after which the surface of the print is again cleaned with benzole and is ready for mounting, like any ordinary photograph.

THE AUTOTYPE CARBON PROCESS.

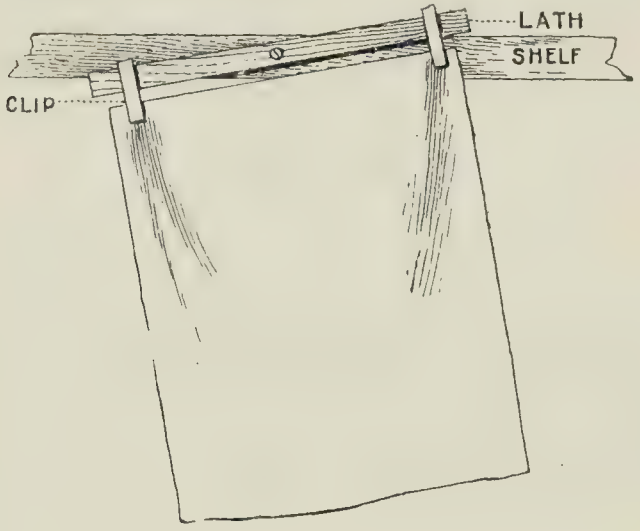
The double transfer process was employed by the Autotype Company in the preparation of two three-colour prints which were shown at the exhibition held by the "British Journal." A semi-transparent temporary support of paper was used, and the process and its results, as shown afterwards at a demonstration before the Royal Photographic Society, were quite satisfactory as regards register and certainty of working. The Company have, however, improved on the original process (details of which will be found on another page in this volume under "Epitome of Progress"), and their present procedure, worked out by Mr. H. J. Burton, is based on the use of coated glass plate as the temporary support. Neither this modified process nor its predecessor, nor, indeed, any three-colour process which involves the assemblage of three components, can be called rapid if a single print only is concerned, but there is no reason to regard Mr. Burton's procedure as unpracticably prolonged if a batch of prints is under treatment together. The remarks made above on the commercial aspect of three-colour printing entirely apply to the carbon process as offered by the Autotype Company, for every operation from first to last is such as to be quickly mastered by the unskilled.

The temporary support used is glass, from which the tissues are subsequently transferred to paper by a solution of hydrofluoric acid and alum. Ordinary 15 or 21 oz. window glass is coated with a substratum of:—

Hard gelatine	½ oz.
Water	20 oz.
Potass. bichromate (5 per cent. sol.)	1 oz.

This solution, which, of course, is made by soaking the gelatine in part of the water and using warm or hot water to make up to the total bulk, is filtered and placed in a flat-bottomed dish, which, in turn, stands in hot water. The glass plates are put in, one side quickly flooded with the solution and the plate as quickly removed to drain and dry, daylight being allowed free access in order that the gelatine may insolubilise and form a firm skin on the glass. These plates should be prepared in advance; they will keep indefinitely.

The tissue is sensitised by two minutes' immersion in a 2½ per cent. solution of potassium bichromate, and is hung up to dry without squeegeeing. A convenient fixture of Mr. Burton's may be shown here. It is simply a strip of wood pivoted in the centre on



a screw. The tissue is attached by two clips, and the board given a turn so as to let the tissue drain from one corner.

The exposures needed for making the light prints, which are all that are needed for tri-chromatic work, are too short—40 seconds to 2 minutes—to permit of an actinometer being used in the regular way. It is best to make a test of the light with a Watkins or Wynne meter, or with a piece of P.O.P. exposed until it exhibits a standard tint, and, from the time noted, expose a trial strip of one of the tissues. The exposure is shortest for the blue and longest for the yellow tissue, being, say, in such a ratio as :—

Blue : Red : Yellow : 40 : 70 : 120 seconds.

The exposed tissues are placed in cold water, and brought under water upon a glass coated as described above. The two are removed together, squeegeed into contact and stood aside for about ten minutes. We now have each of the three prints mounted on its gelatined glass, and from this point onwards the squeegee is not again used, the tissues adhering by simple contact.

Development is done in the usual way in water about 100 deg. Fahr. The methods of local control practised in carbon printing can be applied, and allow of errors in exposure being corrected and of alterations being made in the effect obtained. When judged to be sufficiently developed, the prints are rinsed in cold water and stood aside on their glasses to dry. No alum is used at this stage. We are now to prepare for the transfer of these prints one by one

to the final support of bank paper. The yellow print is picked off first so that it lies next the paper. It is then applied to the glass bearing the red print and pulled off, carrying the red image on top of it. Finally the blue tissue is picked up in the same way.

The bank paper ("bank post" paper, as it is called) requires soaking for at least an hour in cold or tepid water before use. It is then brought into contact, under water, with the yellow print, the glass plate removed with it adhering, and stood aside to dry.

When quite dry, the following transferring solution is mopped over it conveniently with a Blanchard's brush:—

TRANSFER SOLUTION.

Alum	½ oz.
Hydrofluoric acid	½ oz.
Water	20 oz.

This solution is applied sparingly to the print on its glass support so as to penetrate every part, and after about five minutes the transfer solution is washed away and the plate, which now has the yellow print almost detached from it, placed in water.

The glass carrying the red print is now placed in water, and the yellow print adherent to the bank paper lifted off on to it—face-down under water without squeegeeing. The two are removed together from the water, held over a piece of white paper, and the red print adjusted, as can easily be done, into register with the yellow.

The glass with the red and yellow films is set aside to dry, and treated, as was the yellow print, with the transfer solution. The red and yellow images are thus detached and laid, face down, on the plate in the manner already described.

The triple print is now complete on the glass. After drying, it is treated with the transfer solution and brought on to a piece of single transfer paper, the prepared face of the transfer paper and the back of the bank paper support being brought into contact under water and hung up to dry. The single transfer paper should have been soaked in cold or tepid water for an hour previously to use.

The finished trichrome print consists of the three films (cemented firmly together by the skin of insoluble gelatine removed, at each operation, from the glass temporary support) of the thin bank paper and of the stouter support of single transfer paper. Its appearance does not in any way suggest its complex character, being exactly like an ordinary print, and having a surface resembling the average "carbon" print.

If a rough surface is preferred for the prints, it can very easily be obtained by using a rough paper such as "Creswick" in place of the single transfer paper, with the precaution to fill the interstices of the latter with starch so as to provide a smooth surface to which the bank paper can adhere: the texture of the "Creswick" paper will be imparted to the surface of the trichrome print.

CARBON TRICHROMES BY THE OZOBROME PROCESS.

The new method of Mr. Manly of preparing carbon prints from bromides by contact, without light, has been used already for the preparation of three-colour prints, although the ozobrome process has been on the market for three months only. The manipulation of the process will be understood from the account in "Epitome of Progress," though it may be assumed that special steps are to be taken to ensure accurate registration. Possibly the transfer of the carbon image to the celluloid will be found advisable. At any rate the process should accelerate the making of a complete three-colour print, and Mr. Manly, who tells me that he hopes shortly to place facilities in the way of the colour-worker, believes he will be able to prepare a finished trichrome in less than two hours by the ozobrome process.

THE SANGER-SHEPHERD IMBIBITION PROCESS.

This process, first described before the Camera Club in 1900, is based on the use of three gelatine reliefs made from the negatives. These reliefs are dyed by immersion in water-solutions of the respective colours, and are applied successively to a piece of gelatine-coated paper, which abstracts the colour absorbed by the relief of hardened gelatine. Thus the process does not require the action of light after the printing plates have been made. These latter are made on celluloid coated with gelatine emulsion of silver bromide, which is sensitised with bichromate, just as in the Sanger-Shepherd transparency process, the silver bromide serving as an indication of the correct exposure. They are exposed through the celluloid, developed in warm water, and the silver bromide afterwards fixed out, and the paper immediately dyed for printing.

The celluloid films are sensitized in the usual way (by gaslight), and dried in the dark, so that seven or eight hours are occupied by the process. They may be kept in good condition for a little over a week, or for months if stored in air-tight calcium chloride tubes. On exposure (celluloid side to the negative) the details appear faintly as a brown image, and when all are plainly visible (in appearance like an undeveloped platinotype image) the exposure has been sufficient. The temperature of the developing water should be kept at about 100 deg. Fahr. Much greater heat will endanger the shape of the celluloid. Development appears to take place very quickly, but should be continued for fifteen or twenty minutes, to remove the whole of the soluble gelatine. When correctly exposed and developed, the highest lights should have the thinnest skin of gelatine over them without the shadows being choked up. They are then rinsed for a moment and fixed in hypo ($\frac{1}{2}$lb. per pint) for a minute or two until the white silver bromide is gone, and the relief is perfectly clear gelatine. After then washing in running water for ten minutes the films are ready to be dyed.

The printing colours are supplied in water-solutions which are mixed with about four times their bulk of water to form the dye baths. The celluloid plates are soaked in these diluted solutions, and may then be laid in register on each other to obtain a fairly-accurate idea of the colours of the reproduction, though in this form the effect has not the full vigour of the trichrome on paper.

TAKING THE IMPRESSIONS FROM THE PRINTING PLATES.

The special gelatine-coated paper which is to receive the three-dye images is soaked in plain water for about ten minutes and laid, wet and coated side up, on a glass plate. The pink printing plate (green-screen negative) is lowered from one corner upon it and squeegeed into contact. Any superfluous water is dabbed off with a cloth, and the plate and paper left for a few minutes under a piece of damp blotting-paper. The whole of the colour will pass from the printing plate to the gelatine-coated paper. The yellow plate, which is the next one to be printed, is now lowered on to the pink impression, after having rinsed the plate for a moment in water and dropped a little water also on the corners of the pink print. The two are lightly squeegeed together, and exact register then obtained by sliding the yellow plate, the twenty or thirty seconds which elapse before the yellow dye commences to transfer permitting of registration being made in this simple way. In a similar way the blue impression is transferred, the print remaining wet during all three operations, and thus obviating any difficulties in respect of non-coincidence of the images.

A very great advantage of the Sanger-Shepherd process is the facility with which any one of the colours may be strengthened by a second application of any one of the printing plates. Quite distinct from manual retouching (which may be done, if desired, with the greatest ease by means of diluted dye solutions applied with a brush), the print may be controlled by emphasising one or more of the red, blue, and yellow impressions, and this may be done as tentatively as may be desired. The print may be given a matt or enamelled surface by the usual methods of P.O.P.—viz., by stripping from polished plate-glass or waxed ground-glass.

Messrs. Sanger-Shepherd, in their instructions, give the following conditions as emphasising the points where beginners are most likely to go wrong:—

Printing Plates Sticking to the Paper.—The paper has not been soaked long enough before use. Soak in clean cold water for at least ten minutes.

Printing Plates take up the Ink all over when Immersed in the Ink-Bath.—Over-printed relief; the relief must be thin. The best results are obtained by slow development in water at 100deg. to 105deg. F. It is because of the necessity for using a very low relief that we recommend a thin negative.

Dark Muddy Prints.—Printing plates stained up too deeply, or the relief is over-printed.

Blurred Prints.—Paper too wet, or too long time has been taken in the transfer owing to an unsuitable relief. With a correctly printed relief from a suitable negative the whole of the ink will transfer to the gelatinised paper within five minutes. The finished print should be at once pressed surface-dry between clean blotters, and pinned up to dry in a current of air.

The finished three-colour prints by the process have a beauty of colouring which is quite distinctive, and arises, no doubt, from the intimate mixture of the colours in the gelatine film. The most important technical point to be borne in mind is the making of a correct set of negatives in the first instance. Strength and vigour

in these latter such as is thought suitable for ordinary photographic printing in platinotype or carbon are altogether unsuitable, as they give rise to reliefs which are too deep and from which the dyes will not transfer properly.

THE PINATYPE PROCESS.

Strictly speaking, pinatype is not a photographic but a photo-mechanical process of making colour prints, since the actual preparation of the latter does not require the agency of light. But the process is entirely photographic up to the final point, and is in no way comparable with colour-printing methods employed in the illustrating crafts.

In principle, pinatype is the antithesis of processes such as, Selle, Sanger-Shepherd, in which a dye is fixed by hardened gelatine. In pinatype it is the soft untanned parts of a gelatine image which absorb the special dyes and give them up again to gelatine-coated paper. The harder parts, *i.e.*, those exposed to light with potassium bichromate, do not absorb the dyes. This sharply marked difference in the behaviour of the dyes towards exposed and unexposed bichromated gelatine is the basis of the process.

From the set of three-colour negatives, positive transparencies are made, and prints made from these on plates coated with bichromated gelatine. These, after washing, are dyed to form the "printing plates." The dye in each case fixes itself to the parts unhardened by exposure to light (the shadows of the original subject), and after a rinse to remove excess of the colouring matter, an impression is taken off on paper after the manner of the hectograph or "jellygraph." The paper is laid in turn on the other two dyed "printing plates," and the three impressions thus obtained on the same sheet.

The pinatype process thus consists in making:—

1. A set of transparencies (on a lantern-plate emulsion);
2. A set of "printing plates" on the plates supplied for the purpose; and
3. Three-colour prints from these latter by means of a gelatine-coated paper applied successively to each dyed print-plate.

In making the transparencies the chief danger to be avoided is too great strength or "pluck." The vigour of the ordinary lantern slide is altogether too great and leads to the want of detail in the high lights which is the commonest defect of pinatype prints. The character of the transparency should be that suitable for the making of an enlarged negative, *i.e.*, of no great density anywhere, nor with any perfectly clear glass. This quality can be got by giving a liberal exposure and using a weak developer. The formula recommended by the makers is:—

A. Pyrocatechin	210 grs.
Soda sulphite, cryst.	2 oz.
Distilled water to	20 oz.
B. Potass carbonate	2½ oz.
Distilled water to	20 oz.

A. 1 oz.: B. 1 oz.: water, 1 oz.

The added water in this formula may be increased with advantage unless the negatives are such as to print abnormally soft.

The "print-plates" are purchased in the insensitive condition, and are sensitised in a bichromate solution made by dissolving 1 15-grain "chrome tablet" in 2 ozs. of water, being immersed for three or four minutes by weak daylight or lamplight. The sensitising solution should be kept below 70 deg. Fahr. in temperature, and after having been once used for a batch of plates is best thrown away. The plates, after drying in a warm dark place, can be kept in working condition for two or three weeks.

In printing from the transparencies an actinometer is almost absolutely necessary. One of the multiple tint pattern, using collodion or albumen paper, is very suitable, and it will be found that the sensitiveness of the plates is very near that of collodion P.O.P. The image is visible after exposure as brown on a yellow ground, and the plate is at once washed in changes of water until the drainings, when run off on to a sheet of white paper, are free from yellow colour. About ten minutes will usually suffice for this, and the plates may then be dried and kept until wanted, or dyed at once.

To avoid mistakes each plate should be marked with the colour it is to be printed in, in ink in one corner.

The method of dyeing and printing from each plate is roughly the same for each colour, the details being as follows:—

Red-screen Negative.

The *blue* dye bath is made from 10 tablets Pinatype blue in 9 ozs. of water.

The first dyeing occupies about 15 minutes, later ones 5 minutes.

The print is obtained in about 15 to 20 minutes.

Green-screen Negative.

The *red* dye bath is made up from Pinatype red, 10 tablets; liquid ammonia; (·880), 50-70 minims water, 9 ozs. The tablets are rolled into a paste with a little water, enough ammonia added to give a perfectly clear solution and the rest of the water added after 5 minutes. Cloudiness of the bath should be remedied by a little more ammonia, *slight* excess of which does no harm.

The first dyeing occupies about 15 minutes: later ones 3 to 5 minutes.

Printing requires 10 or 15 minutes.

Blue-screen Negative.

The *yellow* dye bath is made from Pinatype yellow, 10 tablets, hot water, 7 ozs. The bath becomes strong after long use but without detriment to its properties.

The first dyeing should take 30 minutes, subsequent ones 5 to 10 minutes.

The yellow print is obtained in about 30 minutes.

In each case the plate after dyeing is washed until the adhering water runs off clear, and there should then be a transparency with plenty of detail throughout, with the high-lights almost transparent and the shadows intense. Over-dyeing of the high lights shows that the plate has not had enough exposure, whilst absence of detail from the high-lights is the result of over-exposure.

Taking the Impressions.

The prepared "transfer paper" which is to form the three-colour print is softened in water long enough to expand fully. The precise time must be judged by its behaviour afterwards. If the paper creases up on the printing plate, it is a sign that it has not been soaked long enough to expand completely. If, on the other hand, it becomes slimy and slips about on the plate, it has been soaked too long. The paper should be brushed over while in the water to remove any air-bubbles which would show as white spots in the print.

The dyed plate and the soaked paper are brought together, thoroughly wet, allowed to drain for a minute, and the excess of moisture then pressed out by passing the palm of the hand over the back of the paper. The paper is then firmly squeegeed on to the plate, the latter being laid on a pad of blotting paper, and a piece of oiled silk or waterproof paper laid over the transfer paper. The squeegee —which should be of the roller variety—is applied from the centre outwards in each direction, just as in carbon printing. As soon as the paper adheres properly it is covered with a damp blotting pad, a glass, such as an old negative laid on top, and the whole left to itself under a light weight. The progress of the "printing" can be seen by carefully lifting up one corner of the paper and squeegeeing down again if the image is seen to be not intense enough.

In the case of the red plate, which must be adjusted in register on the blue print, the transference of the dye may commence before the adjustment has been made, and it is therefore well to insulate the plate from the blue impression with a piece of thin celluloid. When register has been obtained the paper is clipped firmly to the print-plate, leaving the celluloid free to be withdrawn when the print plate is flooded with water and the paper squeegeed down upon it. This safeguard is not necessary in the case of the yellow print, which transfers the dye more slowly.

Dr. König has testified to the permanency of the pinatype prints after some months of exposure, but he, nevertheless, advises a "fixative" in the shape of a solution in which the finished prints are immersed for 1 or 2 minutes, being finally washed in clean water for 5 minutes.

In the pinatype process the sequence of colours advised by the makers is as follows:—

	Blue	Yellow	Red
or	Blue	Red	Yellow
or	Red	Blue	Yellow

The method of reducing prints which have been printed too deeply in one or more colours and have not been fixed is the simple one of moistening them and squeegeeing them down to a damp plate or paper coated with gelatine just as in making a pinatype print. The

gelatine surface abstracts the dye or dyes from the print. Old unused dry plates may be used for this purpose, but not old negatives, on account of the variable hardness of the gelatine in the different parts.

Unfixed prints which are too weak may be strengthened by re-squeegeeing them to the print-plate.

Retouching may be done on the wet prints with the weak dye solutions applied with a brush.

LUMIERE PROCESSES—PAST, PRESENT, AND FUTURE

The Lumière Brothers, of Lyons, were early in the field of colour photography, first with a dyeing process for transparencies and afterwards with two methods for preparing prints on paper. The first consisted in making prints on bichromated and pigmented paper, which, was impregnated with shellac to prevent expansion. Prints of low relief—cochineal red was incorporated to prevent too high a relief—were made and transferred to a collodionised glass plate, which served as the temporary support. Each was then stained, transferred to gummed paper, and all three finally assembled on a final glass support. The process in skilled hands was capable of yielding extremely fine results, but it proved too complex to be capable of general adoption.

It was succeeded by the process known in this country as the L.N.A. (Lumière North American), in which the red screen negative was protected with celluloid varnish and a print taken from it on glossy bromide paper, which had previously been soaked in water for half an hour to produce complete expansion. This paper was exposed wet, developed, fixed, and washed and toned to a greenish-blue by a mixture of ferric salt and potassium ferricyanide, followed by treatment for a short time in a weak acetic acid bath, to improve the colour. Prints were made from the other two negatives on bichromated gelatine, coated on thin celluloid, the printing being done through the celluloid. The thin gelatine reliefs thus obtained were stained yellow and red in special dye baths and applied one after the other to the blue image, the celluloid being stripped off in each case.

This process, the materials for which are still obtainable, would probably have had a greater vogue had not the Lumières applied themselves to the one-plate starch-grain process of colour photography (THE BRITISH JOURNAL ALMANAC, 1906, p. 862), the facility of which in giving a positive or negative in colours at one operation quite puts in the shade the cumbrous processes involving the assemblage of three monochromes.

THE SELLE CARBON PROCESS.

In this process prints are taken in the usual way. Special red, yellow, and blue carbon tissues are developed on a temporary support of celluloid. The three images at this stage can be superimposed to observe the total colour effect. Each print is then immersed in a bath of formalin, and transferred one by one to the final support

of paper by aid of a gelatine solution. The process, the materials for which are supplied by Messrs. Adolf Hesekiel and Co., of Berlin, has shown itself capable of very excellent results.

The following abridged instructions for working it will explain the manipulation:—The tissues are sensitised in a 2 per cent. to 8 per cent. solution of bichromate according to the season and class of negative, 5ccs. of .880 ammonia being added per litre of bath. The excess of sensitiser is pressed out with a squeegee, and the tissue dried within not more than six hours. Printing takes place as usual by actinometer. The prints are then laid in cold water until they lie out flat, and then (under water) brought into contact with the prepared face of the celluloid sheets. The two sheets are laid, paper side up, on a glass plate, covered with a piece of thin rubber and lightly squeegeed together, the strokes of the squeegee being all lengthwise along the paper. After remaining under slight pressure (*e.g.*, in a thick book) for five minutes the prints are ready for development. The water is used at 105deg. to 115deg. Fahr., and in it after a minute or two, the paper is stripped off, leaving the print on the celluloid. The latter is conveniently laid on an opal plate or board for development which is continued until the high-lights are clear. The shadows should then be of only medium density, not heavy. The prints are next laid in cold water and then brought one upon the other on an opal plate just as in the "Rotary" process. The colour effect having been judged satisfactory or remedied by fresh exposures or further development (the latter is only partially successful) each print is placed for 20 seconds only in

Formalin	1 oz.
Water	20 ozs.

to harden the films. The prints are then hung up to dry.

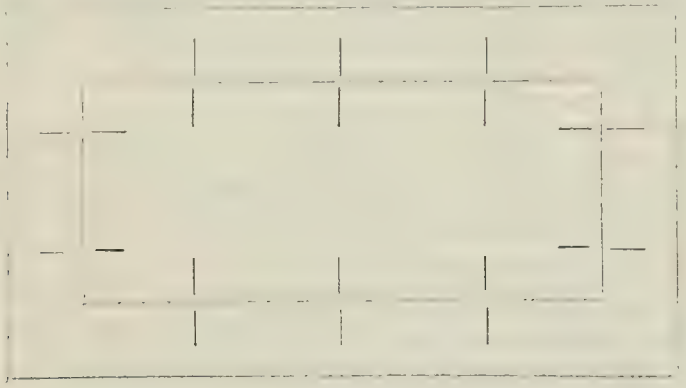
The assemblage of the three monochromes on their final paper support is done as follows:—A piece of commercial transfer paper is laid, film upwards, in a solution made by dissolving 180 grs. of gelatine in 7ozs. of water by the aid of heat, adding 12 drops of carbolic acid as a preservative. The solution should not be warmer than 85 deg. Fahr. when the transfer paper is laid in it. The latter is allowed to become flaccid and the yellow celluloid film placed film downwards upon it in the liquid, the two removed together and laid, with the paper, underneath a glass plate. The superfluous gelatine solution is mopped off with a piece of soft linen, the adhering pair lifted up, pressed between the filter papers for a moment. It is then laid on one side for a few minutes and finally placed for about a minute in the formalin bath given above. It is then hung up by a clip against canvas to dry. The celluloid then strips off easily, leaving the yellow print on the paper. The surface of the print has now to be cleaned from the substratum originally applied to the celluloid, which is done by rubbing over with a tuft of wool wetted with xylol. The red print is now transferred to the yellow by the same series of operations as those by which the yellow was applied to the plain paper, registration being ensured by adjustment of the red celluloid image to the yellow print in the gelatine solution. In like manner the yellow-red print is cleaned and the blue image laid down on it. The finished print is obtained with a glossy surface, but may be made matt

by coating with a matt-collodion. It is finally mounted with a strong adhesive and laid under pressure for some time.

The celluloid films may be used repeatedly in the process. For this purpose they are freed from gelatine by rubbing in warm water with a soft rag. After drying the side already used is re-prepared for the prints by applying a special varnish.

THE GUM-BICHROMATE PROCESS.

The gum process has been used with success in printing from three-colour negatives when the latter are of large size. Of small work with gum I have never seen good examples, and, indeed, it is only natural to require a fair size of print, otherwise the granularity of the pigment image destroys the detail which should be present in a three-colour print. The methods of three-colour gum are practically those of ordinary gum. The choice of a support which will not alter in shape or size during the two latter sensitisings and developments is the chief difficulty, and one which so far has not been entirely removed. One of the best raw papers is the so-called "No. 6 Imperial Torchon," of J. W. Zanders, Bergisch, Gladbach. It is used by the Hofmeister Brothers, of Hamburg, in making their large multi-gum prints. Though, in their work, each colour is printed from the same negative, the necessity of registration is as absolute as in three-colour work. The paper after its first sensitising is made absolutely bone dry, after which treatment it will expand or contract scarcely to any extent. For registration, the Hofmeisters, who work always from oiled paper negatives, make a series of short lines, about three inches apart, all round the back of the paper used for the print. This is done whilst the paper lies on the negative, which is about two or three inches larger each way than the paper. As a result, a series of register marks is obtained somewhat thus:—



And these lines are made to coincide at each printing. The Hofmeisters find this plan as simple and reliable as any, and their work—ten or twelve printings are the general rule for a single picture—is a fairly severe test of it. Other methods of registration may be used, or for moderate sizes the Cherrills' registering frame, to

which Sir William Abney recently drew attention, will permit of the most accurate register.

There would appear to be no satisfactory blue pigment for use in the gum process, and therefore it is usual to sensitise the paper with a ferro-prussiate mixture for printing from the red-screen negative. A standard formula for this purpose is the well-known:—

A.—Ferric ammonium citrate (green)	110 grs.
Water	1 oz.
B.—Potassium ferricyanide	40 grs.
Water	1 oz.

Equal volumes are taken to form the sensitising solution.

The printed sheet is "developed" in three or four changes of water, and then given five minutes in 1:200 hydrochloric acid (which improves the colour), and finally washed in two or three more changes of pure water and dried. It is then prepared for the yellow and red gum-impressions by applying a 2 per cent. gelatine solution, containing a little chrome alum, to the print as it lies face up on a board. The pigment mixture is made up from 40 per cent. gum arabic solution, saturated solution of potassium bichromate, and the yellow or red colour. The coating, printing, and development operations are done as in the gum process, development being, of course, in the manner known to gum workers as "water development"—*i.e.*, unaided by brush. The recapitulation of these procedures is out of place in the present notes, for anyone taking up the process for three-colour printing must be assumed to possess some experience in monochrome gum-bichromate.

Dr. Julius Moeller, of Copenhagen, who exhibited several effective prints at the BRITISH JOURNAL Exhibition, kindly sends me the following particulars of his procedure:—

From the original negatives, which are 3½ x 4¾ inches, are produced enlarged negatives on paper, which are made transparent with castor-oil, and thereafter supplied with register marks.

As support for the gum prints, I have employed water-coloured paper from Zanders, Whatman, and Allonge, prepared with 2.5 per cent. gelatine solution and hardened in formalin (5 per cent.).

Solutions.

(1) Gum.—40 grammes gum, dissolved in 100 grammes of water.

(2) Saturated solution of bichromate of potassium.

(3) Colours (suspended in gum solution).—Only colours in powder are used, ground with the gum solution, in the following proportions:—

YELLOW:—Cadmium yellow, 2 gms.; gum solution (No. 1 above), 16 ccs.; or gamboge, 4 gms.; gum solution, 16 ccs.

RED.—Madder lake, 5 gms.; gum solution, 16 ccs.

BLUE.—Parisian blue, 5 gms.; gum solution, 16 ccs.

These gum-colours are then mixed with the solution of gum and the bichromate, and then coated on paper. As a rule, each colour is printed twice: a longer exposure for the high lights and a shorter one for the shadows. I print the yellow first, then the red, and, lastly, the blue.

The proportions between the solution of gum, the bichromate, and the gum-colours is as follows:—

Yellow, gum solution, 1 cc.; bichromate, 6 ccs.; gum-colour solution, 2 ccs.

Red, gum solution, 2-2½ ccs.; bichromate, 6 ccs.; gum-colour solution, ½-1 cc.

Blue, gum solution, 2-2½ ccs.; bichromate, 6 ccs.; gum-colour solution, ½-1 cc.

(9 ccs. sufficient to coat a 16 x 12in. sheet of paper.)

The colours are laid on with a camel's-hair brush, and distributed evenly with a badger hair softener. After printing, the picture is to be placed some minutes in water of 64 deg. Fahr., and thereafter developed with running water or spray, and locally treated with a brush.

Having finished development, the picture is treated with a 10 per cent. solution of alum to remove remaining traces of bichromate.

THE REICHEL PROCESS OF CHEMICAL TONING.

Methods of producing the three monochromes by toning a silver image have been described by a number of writers, but the only process of the kind of which I have seen results is that patented by Herr Reichel (English Patent, No. 6,356, 1903). The three-colour prints alleged to have been produced by the method described in the patent specification were certainly among the most beautiful examples I can recall, being equal in range of colouring to those by the carbon process, but without the vividness of colour which characterises many specimens of three-colour prints by pigment processes. The process, according to the details in the patent specification, consists in first making prints from the negatives on a print-out silver paper, the emulsion of which contains strontium or magnesium chloride as a constituent—that is to say, these salts are used (possibly in excess) to convert the silver nitrate into chloride. It may be that the strontium or magnesium nitrate which is formed is the active agent. However, the three silver prints are converted into the monochromes by:—

Bleaching in lead ferricyanide and treating with a chromate or vanadate. For the yellow.

Toning with ferric ferricyanide. For the blue.

Toning with gold sulphocyanide, sodium iodide, and potassium carbonate. For the red.

The print to be toned yellow is bleached in a solution containing ferricyanide of potassium and lead acetate in the proportion of 1 to 1½, is washed for a short time, and then rinsed in acidulated water. Herr Reichel does not particularise, but nitric or acetic acid of 1 per cent. strength, or as strong as the print will stand, is probably the best acid bath. From this latter it is brought into a solution of potassium chromate (not bichromate) or vanadate, which converts the lead ferrocyanide image into one of lead chromate or vanadate.

The blue print is treated with a mixture of potassium ferricyanide and a ferric salt, not the chloride. The sulphate may be used in

the proportion of 10 parts to 16 parts of potassium ferricyanide, and a toning bath thus constituted gives an image of Prussian blue.

The red print is obtained in a toning bath of gold sulphocyanide (1 part), sodium iodide (1.2 part), and potassium carbonate (2 parts), or other alkali. This bath is used preferably before fixing the print, as the toning process is then much more rapid. If fixed prints are to be treated, it is advised to prepare the emulsion with sodium iodide and omit this latter from the toning bath.

The three coloured prints having thus been made, each is separately transferred in the water-bath to a thin wax-coated glass plate, and pressed into contact with a roller squeegee. On drying, the papers are removed, and the three transparencies, each on its glass plate, can be brought together to ascertain the effect of the complete print.

A gelatine-coated white paper is now squeegeed under water to the yellow transparency, and on drying, the paper bearing the print is stripped off. The surface is freed from the coating of wax (with benzole), gelatine solution painted over it, and the yellow print laid down on the blue transparency, to which in like manner it adheres on drying, and is stripped off. The red print is similarly brought on to the paper, and the complete colour print thus obtained.

These details from the patent specification are silent on the method employed to secure the stripping of the paper backing from the gelatine-coated film. A rubber substratum on the paper before coating with emulsion would be necessary, as the paper might then be stripped off wet, and though the patentee says nothing on this point, it is obvious he must use some such device in assembling the three prints.

THE DUSTING-ON PROCESS.

This practically obsolete process has been employed by Drs. Miethe and Lehmann in trichromatic work, though the complexity of the manipulation and the skill needed in its execution are probably insuperable barriers to its adoption for practical purposes. Nevertheless, it may be well to give the details of the process as described by its exponents.*

The three negatives should be thin, soft, and full of detail—that is to say, of a quality which would give a distinctly flat print on collodion P.O.P. From each an equally soft positive transparency is made, either by contact or in the camera. In the latter case, of course, enlarged transparencies may be made. In either event, the transparencies are given a coating of a hard negative varnish before proceeding with the printing.

Save for the difference in the pigment, the method of making each print is the same, and is as follows:—A piece of plate glass, somewhat larger than the negative, is cleaned with ammonia, precipitated chalk, and spirit, as for the wet plate process, taking care to dust off every particle of the mixture. The sensitive coating solution is prepared by softening (and afterwards dissolving) 6 gms. of gelatine in 100 ccs. of water, to which warm solution 20 gms. of

* "Dreifarbenphotographie nach der Natur" (Knapp, Halle, 1904).

grape sugar and 6 gms. of potassium bichromate are then added, with a few drops of carbolic acid. The filtered solution when kept cool in a bottle, with the mouth closed with cotton wool, retains its properties for at least fourteen days. The glass plate is flowed over with the solution, the excess drained off from one corner, and the plate dried. This is best done in a closed cupboard, heated to 140 to 160 deg. Fahr. All the foregoing operations must be done in very weak day or artificial light. As soon as dry, the plate, still warm, is placed in contact with the transparency in a perfectly dry printing frame, and is at once printed either by electric arc or daylight, the exposure to the former being about 45 to 60 seconds at 8 inches distance, or about 2 minutes to the sun.

Development should follow immediately after exposure, and be done by lamplight. If the exposure has been right, a weak yellow negative image, with all details, is visible. To develop, fine powder colour is dusted on with a broad soft brush.

The pigments used by Miethe are the normal yellow of Berger and Wirth, the finest quality dark Krapplack (so-called "dunkler Wurzelkrapplack") of Möwes for the red, and the normal blue of Berger and Wirth.

These commercial colours are further rubbed down in a small mortar and distributed over the printed plate through a small sieve of silk gauze. Plenty of powder should be used—about a teaspoonful for an 8 x 5 plate. After a few moments a soft brush is used to move the powder about. In five or six minutes the picture appears, and development is continued with the brush until all the details of the subject are visible, care being given to preserving the plate from the breath and other moisture.

If the exposure has been insufficient, the colour will be found to take too easily and the plate to have a coarse-grained appearance. If over-exposed, the image develops very slowly and is hard.

Assembling the Monochromes.

The final support for the three powder images may very suitably be a piece of white card, to which the yellow, red, and blue prints are in turn transferred. The process is the same for each. The plate is coated with 2 per cent. collodion, drained for a moment, and a second coating applied. As soon as set, the collodion is cut through round the edges of the plate with a sharp knife, and the plate placed in a dish of cold distilled water. On gently shaking, the film detaches itself completely from the glass. The water is changed once or twice until free from bichromate (*i.e.*, colourless), and then replaced by a 1 per cent. lukewarm solution of gelatine. The white card for the final support of the trichrome is now placed in the gelatine solution underneath the collodion side of the film. The two are removed together, and the film carefully evened out on the card. After drying, it is given a coat of ordinary negative varnish or strong shellac solution, and is now ready to receive in turn the blue and red images, which are transferred to it by repetition of the above process.

THE BLEACH-OUT PROCESS.

This process, of which more has been heard of late, is highly attractive to the photographer, for the reason that by it all the colours of an original are obtained at a single exposure or operation of printing from a coloured original. The principle of the process is one which has been enunciated several times and successively lost sight of. It will be sufficient to refer to the writings of Sir John Herschel, who, in 1842, laid down the rule that colours—he had examined vegetable colours in the spectrum—are decomposed by light representing the complementary of their own spectral composition—that is to say, by those rays which they absorb. Thus:

Blue dyes are destroyed by rays other than blue.
Yellow dyes are destroyed by rays other than yellow.
Red dyes are destroyed by rays other than red.

Thus, if a black surface be prepared, as it can be, from a mixture of blue, yellow, and red fugitive dyes, the action of the rays upon it is easily seen. Blue rays, being absorbed by the yellow and red dyes, will bleach these latter and leave the blue. Similarly red rays, being absorbed by blue and yellow, will bleach these dyes and leave the red. In other words, a ray of any colour, by bleaching out its complementary, produces its own colour. The process thus reproduces colour for colour—that is to say, it would give a direct coloured positive in the camera, and requires a *positive* in colours if positive colour-prints are to be reproduced by exposure to light. The process has been worked out chiefly by Dr. Neuhauss, of Berlin, and Herr Karl Worel, of Graz. The former's most recent formula for the coating mixture is as follows:—

Gelatine	10 gms.
Water	100 ccs.
Methylene blue sol., 1 in 50 water	4 ccs.
Auramine sol. .1 in 50 alcohol	2 ccs.
Erythrosine sol. (.25 in 50 water), about	1.5 ccs.

The most convenient way to prepare this mixture is to first make the gelatine solution, dividing it into three equal portions, to add the one dye to each, and then *gradually* to mix the gelatine-dye solutions. Part only of the erythrosine should be added, and the remainder very carefully added "neat" to the mixture, until the whole just commences to redden. A drop too much of erythrosine lowers the sensitiveness. The mixture also becomes more sensitive if kept three or four hours at about 100 deg. Fahr. before coating.

The formulæ for the sensitive mixtures containing anaethol have been given, but the following is the latest published prescription of Worel ("Photographische Chronik," Oct. 21, 1903):—Paper free from wood pulp is immersed in an alcoholic bath of primrose, Victorian blue, cyanine, curcumine and auramine, to which anaethol has been added. The proper adjustment of the bath is judged from the exposure of a strip of the paper under red, yellow, green, and blue glasses. All these colours appearing on the strip, the bath has been correctly proportioned. The impregnation is done at a tempera-

ture of 70 deg. Fahr., and the paper is drained and hung up to dry at this same temperature. The paper, after exposure, is treated for an hour in benzole, and dried at about 100 deg. Fahr. If the print still smells of anaethol, then it must be treated again with benzole.

The bleach-out process has recently been brought within the hands of photographers by the manufacture of a ready prepared tissue by Messrs. J. H. Smith and Co., of Zurich, from whose agents in Great Britain it can be obtained. As first made, the paper consisted of a double film, the lower of red dye and the upper of green and blue. These two latter are sensitive of themselves, and have their sensitiveness increased by anaethol or similar substance. The lower red film is apparently erythrosine, and requires to be sensitised with hydrogen-peroxide, otherwise the reds do not bleach out. After exposure, the print is taken out of the frame and put into the fixative solution and left for some hours. The dish should be covered to prevent evaporation. On being taken out, the print becomes dry in a few minutes. It is then ready for mounting and varnishing.

Since the above was written, I learn that Dr. Smith's firm has so far improved the paper as to dispense with the peroxide sensitising. The new paper, which will no doubt be on the market by the time these lines appear, is also said to give an improved colour rendering.

CONTRIBUTED ARTICLES.

THE FOCUSSING EYE-PIECE: A REALLY CONVENIENT FORM.

By T. Bolas, F.I.C., F.C.S.

In the old days of photography every camera had a focussing screen, or ground glass, and this ground glass was made use of in the adjustment and focussing of each subject. In those old days, or before the advent of the hand camera, the photographer looked upon it as a personal duty to see to the exactness of register between the plane of the sensitive surface and the ground glass, with or without an allowance for the difference between the visual focus and chemical focus of the lens, and the focussing eye-piece was in constant requisition for this. In our day the photographer accepts the camera adjustment of the maker, but he might do well to give more attention to critical focussing, and as an aid to this I may perhaps put in a plea for a more perfect optical construction of the focussing eye-piece. Achromatism is a matter of considerable importance, as also is flatness of field, and both of these may be secured by adapting a combination of the object glasses of a small opera glass to the mount of the usual focussing eye-piece. An opera glass of dilapidated exterior but excellent optical quality may generally be had second-hand at the transpontine pawnshops for about half-a-crown or so; but an essential is that the purchaser should be able almost instantaneously to recognise a good thing, even if the lenses are dusty or otherwise soiled. The opera glass selected should be an extremely small one, having two-lens object glasses of about 2½ inches focal length. A very little tinkering will now serve to effect a convenient transference of the object glasses to the body of an old focussing eye-piece, the object glasses being mounted as one combination, with the plane surfaces outwards, and the convex faces almost touching each other.

In my own case I find the monocular arrangement somewhat trying, and I prefer a pair of short focus spectacles, as involving less strain on the eyes; indeed, the arrangement is ideally convenient, but short focus spectacles, fitted with ordinary uncorrected glasses, are bad—hopelessly so—as even with the best adjustment each eye uses a non-central portion of the field. Two and a half to three inches is about the shortest practicable focal length for spectacles, even if achromatic and flat-fielded, unless extra distance between the eyes and the object is realised by adopting the principle of the Bücke lens, and this is more or less out of the question when the spectacles are used under the focussing cloth, as nearness of the face to the camera is generally necessitated owing to the difficulty of excluding light. To make the achromatic spectacles of short focus two such pairs of lenses as the pair already mentioned may be mounted spectacle fashion, but obviously the focal length must be

about double that which is expedient for mounting, as a monocular device, on the mount of an ordinary focussing eye-piece. Two old opera glasses will be required, each having object glasses of, say, five to six inches focal length, and to secure reasonable lightness it is obviously desirable to select opera glasses with objectives of rather small diameter. The pair of objectives from one of the opera glasses is first mounted (flat towards the eye) in a spectacle frame; then the second pair of object glasses is added, it being desirable that these latter should screw on and off so as to give a choice of two foci. Such achromatic and flat-fielded spectacles of short focus are not only ideal for fine focussing, but are extremely useful for many fine crafts like retouching.

DEVELOPMENT WITH AMIDOL.

By C. Welborne Piper.

The value of amidol as a developer for bromide paper is fully appreciated by most workers, but many abandon it solely on account of its inconvenience. The usual developer, consisting of amidol and soda sulphite does not keep well mixed, neither does the sulphite alone keep well in solution; hence the developer has to be freshly made up when required. It happens, however, that though a solution of simple soda sulphite speedily deteriorates and becomes useless for the purpose of development, yet such a solution if neutralised with potassium metabisulphite will keep well and be serviceable for an almost indefinite time. Therefore, if a neutralised stock solution is kept handy an amidol developer can be made up at a moment's notice.

This neutral sulphite solution should contain one part by weight of potassium metabisulphite to every four parts of soda sulphite, and a convenient strength is 4 ozs. soda sulphite, and 1 oz. potassium metabisulphite to the pint. For all practical purposes this may be considered to be equivalent to a solution of soda sulphite, containing 5 ozs. to the pint, and any of the published amidol formulæ may be made up upon this basis, even though it is obviously an incorrect one.

A peculiarity of the developer thus made is its keeping qualities while in use. It can be used repeatedly for many plates or prints in succession, and it will be clear and work well when a developer made with plain soda sulphite is nearly exhausted and very dark in colour. In the unused condition it does not keep any better in stock solution than the ordinary formula. That is to say, a weak solution of normal working strength will not keep in perfect condition for more than twelve to fourteen days, while a concentrated solution will not keep at all. But when once used there is a marvellous difference, for while an ordinary formula is done for an hour or so after use, I have used successfully a developer made up with the neutral sulphite a week after it had been employed for the development of several negatives.

It should be noted that satisfactory results cannot be expected with amidol that is not in good condition itself, apart from the condition

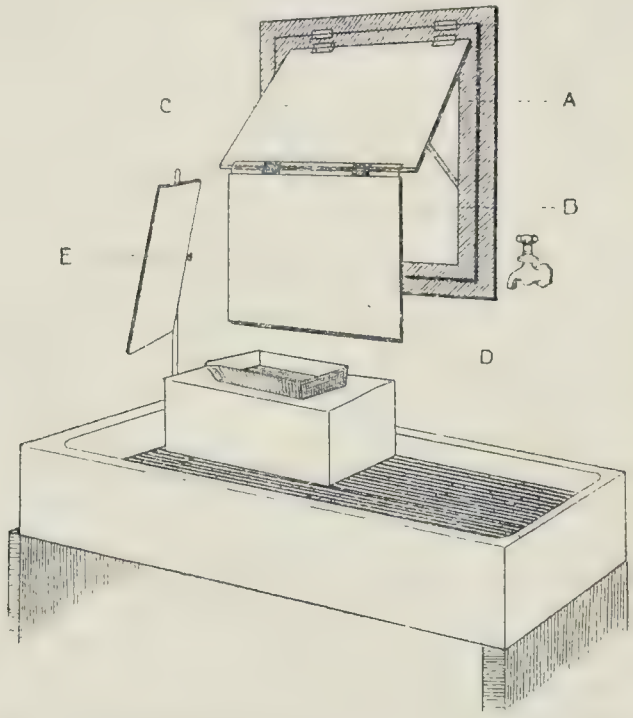
of the sulphite. Stain generally results if the amidol itself is stale, and it is advisable to use it only when either white or light grey in colour. Dark grey amidol is very prone to give stain, while if any blackness is observed the salt is usually worthless. When in perfect condition amidol is completely soluble, and gives an almost colourless developing solution.

DEVELOPING BY REFLECTED LIGHT.

By G. T. Harris, F.R.P.S.

It is safe to assume that the majority of photographers still adhere to the time-honoured method of watching their plate during development, and it is also safe to assume that nine-tenths of them do so by standing in front of their dark-room window and allowing the direct light to fall upon the developing dish, to the detriment of the plate and of their own eyes.

To those who use daylight for the illumination of their dark rooms I would strongly recommend using reflected instead of direct light. It is very much safer, and the relief to the eyes will be a surprise to anyone trying it after having been accustomed to develop in a flood of direct ruby light. Another point in favour of reflected



light is that a much better light can be used, so that objects in the vicinity of the developing sink are readily seen.

The accompanying description of my own dark-room window will enable anyone desirous of doing so to adopt this method. The window proper is about 20 x 14 inches, and is glazed with a single sheet of ground-glass; fitting in this is a frame (A), hinged

at the top, to allow of its being turned up when white light is wanted. This frame (A) is covered with the non-actinic medium, the medium being protected from outside influences by the ground-glass. To the frame A is hinged the screen C, which is of about the same dimensions, and is supported at any angle by an adjustable strut, hinged to the frame A. To the lower edge of C is attached a mill-board flap (D), hinged so as to turn up and lie flat on C, where it is secured by a button. C falling flat against the frame A, and being buttoned in position, the whole can be turned up to admit white light in the readiest manner possible. E is a white reflector on a portable stand, with universal movements, and can be adjusted to reflect the light upon the developing tray, which, together with the operator, is altogether screened from the direct light coming through the window.

My window is protected by one thickness of yellow medium and one thickness of ruby christia, which gives a safe and pleasant light when reflected by the reflector. In fact, I never cover the dish when using ordinary orthochromatic plates, yet have no trace of fog in the time ordinarily required for pyro-soda development.

My gratitude prompts me to say a good word for ruby christia; it is an excellent medium for dark-room windows. The piece I have in mine at present has been in nearly twelve months, yet shows no appreciable sign of fading, although for some hours daily the sun plays mercilessly upon it.

REDUCING AND CLEARING PLATINOTYPES.

By G. R. Ballance (St. Moritzdorf).

Platinum prints accidentally overprinted need never be thrown away. Results just as good as from those correctly timed can be obtained by the following simple method. Immerse the print for about two seconds in the oxalate developer, then quickly transfer to a dish of 5 per cent. hydrochloric acid, a shake for one second, and then back again in the developer, with more shaking, when the picture will come up exactly as one properly exposed, even though it may have had a hopelessly overdone appearance. Of course, the above does not apply to hot bath developer.

The following variation of the bleaching method of clearing platinum prints which have become discoloured through long exposure to sun in show-cases, etc., has been found most efficacious by me. Half a pound of chloride of lime is pounded up and mixed well with one quart of water, and passed through a fine sieve, the mixture having a milky appearance. The prints are soaked for five minutes in 5 per cent. hydrochloric acid, and then transferred to the chloride of lime bath for half a minute (longer destroys the paper). A brisk effervescence takes place, and gases are evolved which make it desirable to conduct this operation out of doors, preferably in a high wind, with the dishes to leeward.

The prints are then passed through two ordinary acid clearing baths to get rid of the objectionable odour, and when washed and dried are as white as when first developed.

ORTHOCHROMATISING BY BATHING.

By A. J. Newton.

To make ordinary plates colour sensitive by bathing has become a comparatively simple matter. It is no longer necessary to have complicated mixtures to sensitise for colour of any particular region of the spectrum, even the deepest red.

There are multitudes of dyes that are more or less active in sensitising, but only those are described in this article that have proved best in experiments made at the L.C.C. School of Photo Engraving and Lithography. The general procedure for bathing in any dye is the same, the first requisites being a good ordinary plate free from fogging propensities, and a dark room as free as possible from dust. If dust is suspected, then water should be sprayed round freely by means of a barber's scent spray bottle.

The dye solution is prepared in a measure, the plates are dusted and laid in a flat porcelain dish, which is large enough to hold nearly twice the number of plates it is desired to sensitise at one time. These are put at one end of the dish; the dish is then tilted, and the dye solution poured into the other (empty) end, then the dish is tilted back, so that the dye solution sweeps over the plates in one even flow free from air bells. The dish is now gently rocked for three minutes, then the plates are removed and washed in a good stream of running water for at least another three minutes. Their sensitiveness will probably be somewhat greater if they are washed for ten minutes. A Russian experimenter is of opinion that bathed plates keep better if they are washed for some hours after dyeing. However, they will remain good for months, kept under proper conditions, after three minutes' thorough washing, if bathed according to the formulæ given below.

The water tap should be fitted with one of those small anti-splash filters, the fine wire gauze in which retains any solid particles that may be in the water.

After washing, the plate should be well swabbed with a wad of cotton wool, and then placed in a drying cupboard. The quicker drying takes place the better, so that if a current of warmed, filtered air, free from fumes, can be sent through the cupboard it is an advantage, though the absence of this convenience need not deter anyone from sensitising plates. Drying can be hastened by placing a dish of dry calcium chloride or quicklime at the top of the cupboard.

To sensitise a plate for the blue-green and green only, that is up to wave length 5.500 A.U., several yellow dyes have been used, such as uranine, thiazo yellow, auracin, canary yellow, and acridin orange N.O. The latter is the best. It is procured from Leonhardt and Co., Farbwerke, Müllheim, Germany, and must be acridin orange N.O., as some acridin yellows do not sensitise.

To sensitise for green and yellow, but not red, that is up to 5,900 A.U., erythrosine—one of the earliest sensitisers—is still the best, though it does not confer an even sensitiveness, leaving the plates somewhat insensitive to bluish green. The best erythrosine is that obtained from Dr. Schuchardt, Görlitz, or from Messrs.

Meister Lucius and Brüning, whose English agents are Fuerst Bros.

These dyes may be dissolved in alcohol 1:1,000, and one part of this stock solution is diluted with 4 parts water to make 1:5,000 solution for bathing. This solution may not be quite the best strength; it is the average of several formulæ, and has been found satisfactory, though it is possible that a weaker solution might sensitise better. The erythrosine solution requires the addition of ammonia .88, in proportion of 1 part to 100 bathing solution. Ammonia must not be used with acridin orange.

As these dyes do not sensitise to red, a red safe light may be used in the dark room throughout the bathing operations. To sensitise for all colours evenly up to the orange red, at from 6,200 to 6,400 A.U., one of the new isocyanines should be used.

Orthochrome T Pinaverdol Pinachrome	} Obtained from Messrs. Meister Lucius and Brüning, or Homocol, from the Bayer Company.

These are placed in order of the sensitising effect towards the red end of the spectrum, though there is not very much difference between them, the first sensitising to, say, 6,100 A.U., and the last to, say, 6,400.

These dyes are made up in 1:1,000 alcohol, and 2 parts of this stock solution, made up to 100 with distilled water—that is, 1 in 50,000 solution. This is the best strength, as has been proved by experiment. The stock solution will keep, but not so the dilute solution. A red safe light can be used, until it is seen that the dye solution has satisfactorily covered the plates, when the light should be shut off and the rest of the operations performed in darkness. The use of a Warwick time meter or a Welborne Piper dark room clock will enable one to give the correct time in the dark. To sensitise for the extreme visible red, pinacyanol (Messrs. Meister Lucius and Brüning) should be used. This is made up exactly as described for the other isocyanines. No red light, however deep, can be used in the dark room, but as there is a slight want of sensitiveness at 5,000 to 5,300, a weak green light, transmitting only colour of this region can be used. Pinacyanol is the best general red sensitiser, but if sensitiveness to the infra-red is required then dicyanin is used, prepared exactly as pinacyanol, except that the stock solution must not be added to the water until the very last moment, when everything else is quite ready, and the plate can be immediately flowed over with the solution, as the diluted solution rapidly loses its power to sensitise, and if prepared even a short while before is useless.

It is best that one lot of plates only should be bathed in one lot of solution. If, however, a large number are to be bathed, and absolute uniformity is not required, then it is sufficient to make up sufficient solution to allow of a fair proportion of fresh solution to be added to that already in the dish for every fresh batch of plates.

It will be observed that ammonia has been omitted from the

bathing solutions last given. No doubt in some cases its use will increase sensitiveness; but unless it is quite pure it is liable to cause fog, and, on the whole, the advantage does not appear worth the risk.

If, however, it is desired to use it, pure .880 ammonia may be added, in proportion of 1 part to 100 parts of the bathing solution.

SOME FACTS ABOUT THE PALMY DAYS OF STEREOSCOPY.

By Dr. Moritz von Rohr, Jena.

One may safely assert that stereoscopy was in its prime between 1851 and 1861. It was at the International Exhibition of 1851 that Sir David Brewster's lenticular stereoscope was brought before the public by the Paris optician, Jules Duboscq. Very soon afterwards the instrument became in this form the craze to an extent that is hardly credible to us. I may mention that five years afterwards —according to Sir David Brewster's statement—half a million of stereoscopes were already sold to the public.

Such a number certainly included a great many cheap instruments, with cheap slides; but, judging from catalogue prices for stereoscopes and stereographs of that time, one comes to the conclusion that there must have been also many of high quality. In a catalogue of 1853, the prices for paper slides range from 2s. to 3s. 6d., and for glass slides from 7s. 6d. to 10s. And even three years later the falling off of the prices is by no means very great. In a catalogue of the London Stereoscopic Company, the "binocular pictures," mounted on card, range from 1s. 6d. to 3s., and for albumen pictures on glass from 6s. 6d. to 7s. 6d. The stereoscopes are listed from 2s. 6d. to 50s., and, besides, there are three selections of stereographs, with a suitable stereoscope, for the price of 5 gs., 10 gs., and 20 gs. I have my doubts whether to-day these prices would be easily realised. It is, however, but just to say that much greater pains were taken on the average at that time for the production of slides than is usual to-day. The paper of John Harmer* might be cited as an instance, where a practical man of the old school speaks of his experiences with a difficult branch of his work. Anybody going through many of these old articles on stereoscopic matters must be struck by the number of successful photographers devoting themselves to this special branch. Their work was regularly reviewed in the photographic press, quite in the same manner as is done nowadays with books and pamphlets. Of their names I may give the following: G. Wilson, E. Anthony, Valentine Blanchard, and W. England.

There is no doubt that so strenuous an application of well-known photographers is impossible without a corresponding appreciation of, and a great demand for, work of the highest description. As a further instance, one may adduce the fact that two monthly journals were devoted exclusively to stereoscopy. They were founded

* Stereoscopic Work.—"B.J.," 1882, 29, No. 1177, 670-672.

at the end of the 'fifties by Lovell Reeve, and had the titles of "The Stereoscopic Magazine" and "The Stereoscopic Cabinet" respectively. The first-named and older journal seems to have outlived the other by some years.

CARBON PICTURES ON CELLULOID.

By E. W. Foxlee.

Celluloid as a permanent support for carbon pictures seems to be but little employed, yet the results are exceedingly pleasing, while they are easy to produce, either by the single or the double transfer method. They look well, either by reflected or by transmitted light, and can, of course, be printed in any colour. The celluloid may be had plain or with an ivory grain; pictures on the latter look very much as if they were on real ivory, and can be coloured just the same as are ivory miniatures. The manipulations, it goes without saying, are precisely the same as in ordinary carbon printing. Transparent celluloid may be had polished on both sides, or polished on one side and matt on the other. The opalescent and the ivory grained may also be had with either of these surfaces, so that quite a variety of effects can be obtained.

If we wish to make the prints by the double transfer method, they are developed on the ordinary flexible support, alumed and dried in the usual way, and then transferred to the celluloid. A good solution for this purpose is that given in the Almanac, which stands thus:—

Nelson's No. 1 gelatine	1 oz.
Water	1 pint.
Chrome alum, dissolved in 2 ozs. of hot water ...	12 grains.

The alum solution should be added gradually and with continual stirring. The celluloid, with the matt surface, should be thoroughly cleansed with warm water and soap, and then well rinsed in cold. The picture and the celluloid are then immersed in the warm solution, then brought into contact and squeegeed together. When thoroughly dry, and not before, the temporary support is stripped off, and the picture is finished. If the surface of the celluloid is polished it will be well to prepare it, as presently to be described.

If the prints are made by the single transfer method the celluloid, after being cleaned, is coated with a substratum as follows:—

Nelson's No. 1 gelatine	1 oz.
Water	1 pint.
Chrome alum, dissolved in hot water	20 grains.

When dry, the film is ready for use. The only difference between this and the above solution is the proportion of chrome alum. If the pictures are made on the polished celluloid there is a remote risk, if they are exposed to abnormally dry conditions, that the gelatine image may contract to such an extent that it may split off. Therefore it is advisable to give the celluloid a slight tooth, so as to bind it the better to the substratum. This can be done by rubbing the surface, lightly and quickly, over with 1 ounce of sulphuric ether, mixed with a pint of methylated spirit.

Single transfer, non-reversed prints on celluloid can be made on thin celluloid—rollable film—by printing through the film, which will not perceptibly degrade the sharpness, and then backing them up with double transfer paper, applied in the usual manner. Indeed, this is about the most simple way of making enamelled pictures, with the advantage that they are not liable to become scratched nor be injured by moisture. Carbon tissue on celluloid is now a commercial article.

SOME PRACTICAL NOTES.

By Edmund J. Mills, D.Sc., F.R.S.

Backing.

The usual red backing is not sufficiently good for long exposures in interior work, and is obviously of no service for colour work where reds are an object. A black backing is clearly indispensable. The backing I now use is a slight modification of the one described in a recent number of the Almanac, and has the following composition:—Water, 5 parts; dry scentless Castile soap, 1 part; white dextrine, 2 parts; powdered "drop black," 4 parts; glycerine, ¼ part. Let the soap and dextrine remain in the water overnight; warm up and add the glycerine and drop black, with frequent stirring. If there is no objection to the expense, a layer of spirit of wine (¼ part) is gently poured over the warm mixture before adding the drop black; this keeps away air bubbles. Squeeze through muslin if desired. Next morning the mixture will have set to a creamy pap, very suitable for laying on. Drop black has the advantage of not dirtying the hands so much as the gas carbon I formerly used.

Colour Sensitised Plates.

Repeated experiments have convinced me that there is no disadvantage in exposing these plates wet. This, I notice, is also the practice of Mr. Harris. Colour sensitising, say, with orthochrome or pinachrome, is such a simple operation that anyone can now make "colour" negatives with very little addition to the usual work.

Softening Portraits.

Much retouching can be avoided by the following simple process, which is more especially suitable for large heads. It must, of course, be known, but one never hears of it: Make a weak carbon transparency on glass, and frame this, in a printing frame, say, with a white or very pale cream card, fixed at a little distance behind it. As the shadows of the positive will now appear to blend with it when looked at, the whole subject will be much softened. The effect varies with the angle at which the frame is set to the light. A new negative is made from the framed transparency so arranged.

Hot Weather Work.

Early in September, 1906, one had to work at 30 deg. C. Under such circumstances, formaline is an admirable help, indeed, a necessity. A good plan is to soak the exposed negative in a 3 per cent. solution of (40 per cent.) formaline for half an hour, and then add to the solution the usual solid or stock developer. The developer should not contain ammonia, and less formaline than the amount stated should not be used. The time of development is about

doubled in this way. A necessary precaution is to thoroughly wash off the formaline before immersion, either in neutral or acid hypo, as it possesses the disagreeable property of throwing down from them a mixture of sulphur with sulphide of silver. Formaline vapour has unfortunately causes the eyes to smart, so that one must, as much as possible, cover up the plate during the first bath and development.

SOMETHING ABOUT FLASH POWDERS.

By A. L. Henderson.

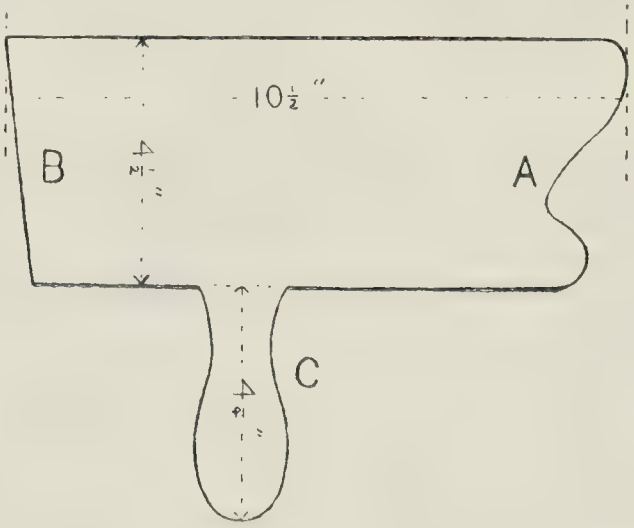
"A good story is none the worse for being twice told." About fifteen years ago I exhibited a flash compound at the L.P.P.A. that should have "caught on"—viz., to mix magnesium in collodion after drying, cutting it up in strips like ribbon or pencil, and marking off in lengths of, say, seconds. The magnesium may be mixed with smokeless powder or with collodion, made with a highly explosive cotton. Since then I have tried many experiments, and I thought I had hit on a very convenient method of using magnesium with weighed quantities of smokeless powder placed in pill boxes. I pierced a small hole in the lid, through which a fuse of celluloid was put, but, to my astonishment, the moment the light reached the hole it went out. However, I got over that difficulty by opening the box just before using and placing the celluloid fuse at the bottom of the composition. The next difficulty which presented itself was due to the deliquescent nature of the compound; it caked, and would not fire until dried. As a remedy for this I suggest that a capsule of celluloid containing the powder be hermetically sealed, leaving a pointed knot to use as a fuse. I will not here give the formulæ of any of the compounds, as they are all more or less dangerous to prepare. I have had many narrow escapes, and, as a caution to your readers, I will give an instance of one of my experiences in this respect. I was preparing an experiment in connection with enamelling, and a slight precipitate being formed, I proceeded to remove it by filtration. The bibulous paper was placed in a porcelain tray filled with water, and there left for a time, leaving the water slowly running to wash away the precipitate. I knew that the composition was highly explosive, but, believing it had all gone, I tipped up the dish, with the result that a violent explosion took place, knocking out the bottom of the tray, whilst the rim remained in my hand.

THE SIMPLEST FORM OF STEREOSCOPE.

By A. Lockett.

Wishing to view some stereoscopic pictures printed in a magazine without mutilating the latter by cutting them out, and not having at hand a pair of stereoscopic spectacles or detachable lenses, the writer, after some experiment, devised the following contrivance, which is undoubtedly the simplest form of stereoscope that can be made, having neither lenses nor mirrors. It consists merely of one flat piece of thin wood or stout cardboard, cut to the shape shown by the accompanying illustration, the end A being curved to fit the nose, while the other end B slopes slightly inward for

convenience in resting on the magazine or book. At C the side is continued in the form of a handle, flat, of course; or, if preferred, a turned handle with a slot cut in the top to receive the card may be glued on. The card or wood should be covered with dull-surfaced black paper or varnish for the best results, though this is not really indispensable.



To use the appliance, the nose is rested in the recess provided for it, so that each eye looks down on one side only of the cardboard or wood, the latter coming in between the two eyes. The bottom end of the contrivance is then placed on the dividing line between the two pictures of a stereogram. Since the right eye can now only see the right-hand picture, and the left eye only the left-hand one, it is obvious that the conditions of stereoscopic vision are fulfilled, providing the two views can be made to coalesce. This, it will be found, depends entirely on the cardboard or wood being cut the right length for the focus of the observer's eye. If this is done, the picture will be seen in correct and beautiful relief without the slightest difficulty. On the other hand, if the card is too long or too short for the person who is using it the pictures do not coalesce properly, but are seen separately, and, as it were, overlapping. By taking at first two rather short trial pieces of cardboard of a rectangular shape, and sliding these backward and forward over each other so that the stereogram is viewed at different distances, until only one picture is seen, the correct length for any sight is soon ascertained. The writer finds a length of 10½in., as shown in the diagram, perfectly satisfactory; but, while a few would no doubt prefer a shorter length than this, most people will probably see better with one still greater—say, about 15in.

This form of stereoscope has several advantages. In the first place, there is the possibility of viewing magazine stereograms without defacing the pages, as before stated; secondly, it is available for stereoscopic slides, transparencies, or pictures of any size, no matter how large; in fact, projected stereograms on the lantern

screen can be made to coalesce in this way, under suitable conditions. Lastly, it is always at hand; for when nothing else is procurable a stereoscope on this principle can be improvised in the simplified form of a plain rectangular card, or a thin book of suitable length, articles never difficult to obtain. To balance these merits, the sole disadvantages of the appliance are that it is not adjustable for different sights, and that there is no magnification.

PRESERVING PYRO IN SOLUTION.

By W. E. P.

I have found the following formula able to give me pyro solution always ready for use within a year of making: Take a convenient quantity of water, say, two ounces and a half (2½ ozs.), this is about 1,200 grains, add to this 3 per cent. of oxalic acid (or 36 grains); when dissolved, add pyro to suit. I like to make it one grain in ten drops, or 120 grains for the 1,200 grains of water (2½ ozs.). Then one drachm, or 60 grains, will contain just 6 grains of pyro. Any other proportions of pyro may be used to suit, as it is very soluble. This solution will *keep*. You may use from it every day. After a year a solution from which I had been using at frequent intervals was "water white," and the bottle was only half full. The same bottle, after two years, was discovered with a little more than a teaspoonful of solution remaining. It was still transparent, but had a slight tinge of colour. Now I hold that a solution of pyro which is colourless at the end of the year, and works well in making up a developer, is, for all practical purposes, a keeping solution. For a part of the time the bottle was opened every day, as I developed plates. At no time was it full, and no especial care was taken in the corking.

As to the strength of the acid solution, for all-round work it must be acid 3 parts to water 100. Two and a half parts is not enough to keep pyro through hot weather. More than three parts is not needed. With fairly pure water, pyro, in my hands, will *keep* "water white," and of full working strength, for twelve months, which is long enough for practical purposes.

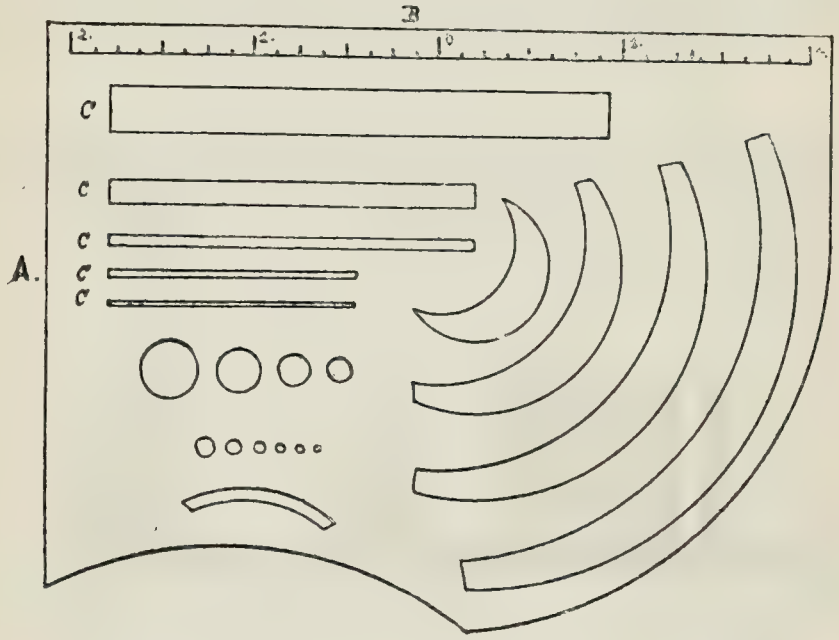
A RETOUCHER'S MULTI-RULE.

By Arthur Whiting.

Take a ¼-plate piece of stout celluloid, such as is used for flat films, and, having ascertained that one corner is an actual right angle, proceed to bevel the edges (A and B) slightly, by laying them flush with the edges of a piece of glass and then chamfering them with a knife. Next proceed to cut a series of slots (C) from one-quarter to one sixty-fourth of an inch wide, commencing the first slot about half an inch from the edge B. The series of curves and circles depicted in the diagram may then be cut out with scissors, knife, and drills, and these should also be bevelled and the edges of the circles countersunk. Lastly, engrave a scale with a knife point (filling in with fixed Indian ink), about one-sixteenth of an inch from the edge B, commencing from the middle, as shown.

We have now a bevelled set square, useful for drawing straight

lines and squares with pencil or (by reversing side), with pen and Indian ink. A series of graduated slots for drawing parallel lines to facilitate the titling of negatives, several curves of special service in blocking out. The circles are useful, both for the latter and for lightening (with the stump) eyes that will print too dark in portrait negatives. The straight and curved edges are also just



the thing (laid on the negative, bevelled side up), to enable one to put on a tint, with cotton wool or tint stump, having the edge sharply defined, thus preventing overlapping other detail. Finally, the graduated scale is handy when equidistant work is needed, as in blocking out a figure from a group, sketching in shoulders, reducing protruding hair, etc. When large negatives are handled the multi-rule may be of a larger size with advantage.

TELE-PHOTOGRAPHY AT HOME.

By J. H. Baldock, F.C.S., F.R.P.S.

I have just constructed a little piece of apparatus, by means of which it is easily possible to get telephoto results of certain subjects in the quiet of the home, without going to the expense of buying a telephoto attachment, or the trouble of carrying one about. As will be seen by reference to Fig. 1, the apparatus is a modification the figure, A. is an incandescent mantle burner (chimney, white glass, of the usual enlarging form, but the speciality is in E (Fig. 1). In of course), or the limelight could be used. B. contains the condenser (in my case an 8½ inch one built into the wall), with a little door

at *a* for introducing the negative, either ¼ or ½-plate, and also for seeing the time by a watch for the exposure. C. is for the bellows extension. D. is for the lens used in ordinary enlarging, behind which is a drop shutter, with a 2-inch circle of ruby glass let in; this answers the double purpose of enabling the sensitive paper being pinned on the easel, and for making the exposure, but at *b* is a special arrangement, having a rising and cross front, by means of which any part of a negative can be brought opposite the lens at E. (in which case the negative is *not* put in at *a*). E. is the speciality referred to above, which slides smoothly in a groove at *c*, and carries

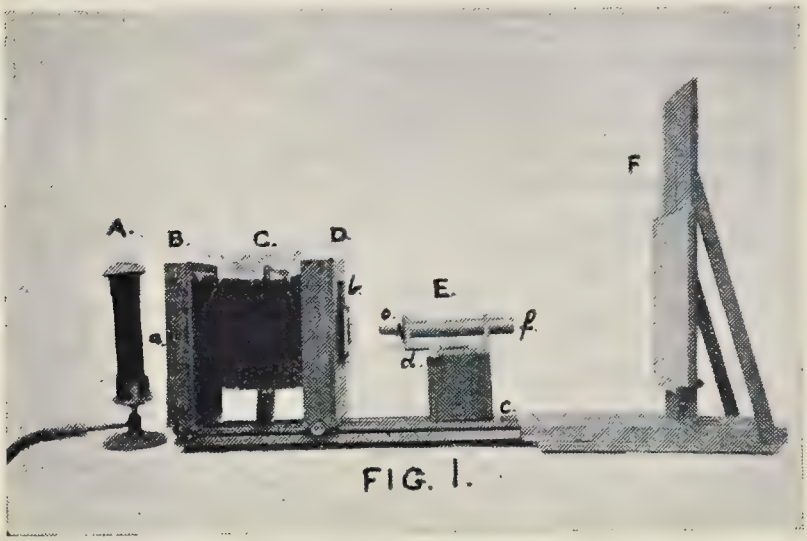


FIG. 1.

a rack work (spiral by preference), which moves the lens at *d*; there *may* be, as at *f*, a 6-inch brass tube, lined with black velvet, but it is not essential; lastly, at F. is the easel, which also slides smoothly to and from the lens, according to the lens employed and the size of the picture required. In the figure, the lens shown at *e* is a 4-inch micro-objective, corrected for chemical focus, but either a 2, 3, or 4 inch photographic lens will do quite as well.

It is obvious that the apparatus depicted in Fig. 1 can be used in a three-fold manner—*i.e.*, for ordinary enlarging of the whole negative, for tele-photo enlargement of any small part of a negative, or for photo-micrography, when high magnification is not required, the alteration required to use it for either of these purposes being very easily and quickly made.

STEREOSCOPIC SEPARATION

By Victor Selb (Brussels).

Beginners in stereoscopic work frequently ask the questions "What is the proper separation?" or "At what separation is it best to

work?" No exact answer is given to these questions in the various text books, and for this reason I venture to give my own observations and experience. The separation in stereoscopy is of different kinds.

A: That between the two lenses, centre to centre.

B: That between the two images, on the ground glass or negative.

C: That between the positive images, on glass or paper, mounted as transparencies, or as paper prints.

These different factors must not be confused, as their effects are different.

A: The separation between the lenses determines the effect of solidity. The lenses reproduce artificially the sensation of solidity, which, by aid of our binocular vision, we experience automatically. Writers are by no means in agreement on the importance of this separation. Some recommend a fixed separation of 2 9-16 inches, the average separation of the human eyes, whilst others suggest the adjustment of the separation, according to the distance of the subject from the camera. Hand cameras being usually made to focus subjects at from 12 to 24 yards distant, it has proved, in my experience, quite satisfactory to adopt a fixed separation beyond 2 9-16 inches; it is nevertheless better to extend same to 3½ or even 4 inches, the effect of solidity of the blended images will consequently be the more realistic and startling. However, for subjects nearer to the camera, such as portraits, statues, flowers, etc., the distance of which many not be more than 5 or 6 feet, the separation would not exceed 2 9-16 inches, whilst with subjects still nearer, this separation may be advisably reduced to 25 or 50 per cent. less, according to the nature of the subject. On the other hand, if one wants to obtain effective stereograms of distant landscapes a more considerable separation between the lenses than 4 inches will be required. For example, when photographing the Alps, at a distance of about four miles from the camera, the effect of the different planes is best obtainable with a separation of about 100 feet between the lenses.

It must be remembered that in adopting such a separation the foreground must be entirely dispensed with, that the blended image will appear reduced in size, and that the second negative is obtained after moving the apparatus the necessary distance.

B: The separation of the two images on the negative. That part of the plate in which the negative images are not homologous is useless for making the final stereoscopic slide. In a hand camera, with a fixed separation of lenses of 3½ inches, and covering a negative plate measuring 6¾ inches in length, with a subject taken at 40 feet, the composition of the plate will be as follows:—

⅛ inch will be lost as margin on the edge.

3 inches will form the left-hand image.

½ inch will be lost in the centre of plate by partition, and images non-homologous.

3 inches will form the right-hand image, and ⅛ inch will again be lost as margin.

The construction of hand cameras, with a view to economise weight and bulk, is often so reduced that same cannot admit plates beyond 4½, 5, or 5½ inches in length, and therefore it is evident that in

such cameras the separation between the lenses has to be reduced, at the cost of losing part of the effective solidity of image. One therefore often sees stereograms possessing the defect of a flat image, and resembling the scenery of a theatre. The above remarks must only be applied to the stereograms of normal size—viz.: $6\frac{3}{4}$ x $3\frac{1}{4}$ inches, taken with lenses of about 5 inches focus. I have had no experience at all with slides deviating from the usual normal size, such as those obtained with the "Verascope," 4 x $1\frac{3}{4}$ inches, or other small cameras with lenses having as little as $2\frac{3}{4}$ or 3 inches focus. Short focus lenses, of course, permit smaller separation between them without loss of stereo effect.

C: The separation of the two images as transparencies or prints. This separation, which must not be confounded with two others, is absolutely fixed and invariable. It is based on our binocular vision, and both experience, and the authority of almost all writers upon the subject, have placed it at a maximum of 2 15-16 inches.

It is therefore necessary that the left-hand image be placed horizontally by the side of the right-hand image, in such way that the separation between corresponding points in the subject does not exceed 2 15-16 inches; this measurement being taken, not between the immediate foregrounds, but between the backgrounds of the images. In order to facilitate the examination of stereograms by persons having their eyes at less than the normal distance apart, it is even recommended that this separation should not exceed $2\frac{3}{4}$ inches. This strict limit of size may appear of no consequence for those who are in the habit of examining stereo slides with so-called American "open scopes," provided with prismatic lenses of long focus, and by which the blended image is seen of small size.

However, when using a good and suitable stereoscope, with short focus periscopic lenses, the length of focus not exceeding the one of lenses used for the taking the negative, and consequently representing the blended image as of nature's size, then the mounting of stereograms must be within 2 15-16 inches between homologous points, as stated above.

REDUCING PRINTS AND A USEFUL HINT

By Rev. T. Perkins.

I have long been in the habit of using the ferricyanide reducer for decreasing the density of over-dense negatives, for introducing some indication of clouds when the sky printed white, for clearing lantern plates which had become slightly veiled in development, for emphasising the high lights, and for giving the appearance of white clouds when in the transparency the sky was too dark; but it was only recently that I thought of using it to reduce paper or cardboard prints that had been overdone. For many purposes, I find the self-toning paper, glossy or matt, exceedingly useful, but some brands grow so much darker in drying that a print which looks right enough in the washing dish after fixing, is seen to be altogether over-printed when it is dry. I had, when first using this especial kind of paper, a rather large number of prints spoilt from having been

exposed too long under the negatives. It occurred to me that possibly the ferricyanide reducer might improve matters, so I mixed some up, just as I use it for negatives, and put a print into it, with the result that it was immediately almost washed out; evidently the solution was much too strong, in fact, it is almost impossible to have it too weak. A single minim in a drachm of clear fixing bath (4 ozs. of hypo to 1 pint of water), with water sufficient to make it up to an ounce is quite strong enough; in a very short time this will considerably lighten the print. The print must not be allowed to remain even in this weak solution too long, or the half tones will disappear. It is necessary to hold the dish of solution in one's hand to keep it in motion, and carefully to watch the progress of reduction, and pour off the solution and swill the print under a tap. As soon as the print is sufficiently lightened the print will require after this as much washing as it would after fixing. The reduction may be effected either before or after the print has been dried. In the latter case it should be wetted by placing it for a few minutes in clean water.

Not long ago I started from home with my camera, but forgot the tripod screw. This omission did not trouble me much, as I knew that by cutting a twig of the right size from the hedge, and by screwing it in the place the screw should occupy, it is possible to fasten the camera to the stand; but as I had to pass through a town, in which there was an ironmonger's shop, I went in and asked for a small screw and nut. For the sum of one penny I became the possessor of two "gutter screws," as they are called, because they are used for fastening together lengths of the shooting placed along the eaves of the roof. One of these I passed through the hole in the camera baseboard and the tripod head, and, screwing the nut well home, effected a close and firm contact between the tripod top and the camera. So well it answers that when I pack up my camera, after finishing my work, I put the screw through the tripod head and secure it by the nut, so that it remains there till the camera is used again, and it is impossible to go out without it, unless the whole tripod head is left behind.

EXPOSURE WITH THE YELLOW SCREEN.

By Arthur Payne.

I much prefer to use the term "light filter" rather than the more popular expression "yellow screen," and it is only because the latter phrase is popular that I have used it in the heading of this short note.

As all should know, it is only an accident that the light filter, used to correct the colour rendering of photographic plates, is yellow; and as the term "yellow" is so very elastic, embracing, as it does, all the absorption properties of the different compensating light-filters which are used in order to correct, or compensate, the colour rendering of different brands of plates; it is most desirable that they be referred to by their proper name.

It is satisfactory to know that photographers are overcoming

their prejudices (or is it fear), and are using colour-sensitive plates in preference to the more colour blind ordinary plates; but there still appears to be a deplorable lack of knowledge of the true principles of orthochromatic photography, which finds expression in the manner in which the light-filters are referred to as a 10-times or a 3-times "yellow screen," as though the light-filter possessed some inherent quality which always ensured that the exposure would be increased ten times or three times, whenever the light-filter was used, and with any brand of plate. It is to be hoped that there will shortly be an improvement in this respect, for, as is well known to any student of photography, the exposure-factor of any light-filter depends entirely upon the particular colour-sensitiveness of the plate with which it is used, and not on itself alone. It is hardly necessary to explain that a light-filter used with an ordinary, or blue-sensitive, plate, will have a high exposure factor, whilst if it be used with a plate possessing great sensitiveness to the yellow rays the exposure factor may be low.

There is also another, and more important, reason why it is not desirable to use the loose term "X times yellow screen," since it entirely fails to give any information as to the influence it has had in improving the colour rendering of the plate with which it is used. Consequently it is more desirable to state that a plate has been used, corrected for colour rendering, than to merely state that this plate was used with, say, a 10-times yellow screen, or whatever the exposure factor happened to be. In this case it is to be understood that the light-filter used compensated the colour rendering of the plate, so that the colours were reproduced in the same luminosity as they appeared to the eye at the moment of exposure.

From motives of exposure, and on the principle that half an improvement is better than nothing, it is sometimes necessary to use a filter which only gives half the colour correction and approximately halves the exposure. Such a combination may be referred to as a plate which is half corrected for colour rendering; or, in extreme cases, it may even be necessary to use a quarter correction; but it is not desirable to go beyond this limit, as any further reduction will not, in the great majority of cases, have any apparent effect upon the appearance of the print, and therefore the plate may just as well be used without a light-filter.

ON INSTANTANEOUS PHOTOGRAPHY AND A METHOD OF TESTING SHUTTERS.

By H. G. Ponting, F.R.G.S. (Tokio).

Probably very few, comparatively, of the hundreds of thousands of users of photographic shutters ever pause to question the figures which they find upon them relating to their speed. The most cursory examination of the between-lens type most commonly used must convince even the tyro that he has been "done" if he thought he was getting an instrument that would work up to the, or at the, speeds stamped upon it.

I say "stamped," and here is always ground for suspicion. Never

put your confidence in figures which have been pressed on to metal strips by the thousand.

In anything so delicate as the adjustment to small fractions of a second, naught but the makers' individual test of each instrument can decide the exact spot where those figures must go, as every shutter has its own individuality, and in a hundred shutters, alike in all other respects, the positions of the figures will vary, and, indeed, in most cases, the higher figures have no business there at all.

I have tested many, and have never found one of the ordinary brass and nickel between-lens shutters that would work to a hundredth of a second, or anywhere near it.

Only where the figures are carefully *engraved* can you have any reason to suppose they are there as the results of testing.

In all probability your hundredth is not faster than a fortieth, the following being about the average of the tests I have made:—

MARKED.		ACTUAL.
sec.		sec.
$\frac{1}{100}$	=	$\frac{1}{40}$
$\frac{1}{50}$	=	$\frac{1}{40}$
$\frac{1}{25}$	=	$\frac{1}{10}$
$\frac{1}{5}$	=	$\frac{1}{2}$
$\frac{1}{2}$	=	$\frac{1}{2}$
1	=	$\frac{1}{2}$

This is the usual thing I find. Try the slower figures with your stop-watch.

Out of half a dozen blind shutters I have owned, I have not found one that would work as fast as claimed for it, and of four stereoscopic shutters of the behind-lens blind type I have never possessed one that would work faster than 1-35 of a second.

Focal plane shutters, if running freely and easily, without any grinding sound, may be assumed to work to their indicated speeds. I have timed several, and at present own three, any one of which with a 1-16 inch slit, registers on my speed-testing apparatus 1-2,500 of a second.

Now, it is just as important to know the exact speed of your shutter, as in careful work it is to know how much exposure you dare give the subject, and it is a good idea always to give it as much as it will stand. To calculate this is a very simple matter.

At a distance of 100 times the focal length of your lens a movement of one inch is practically imperceptible on the plate, because the movement on the plate will be but 1-100th of an inch, and this is about the maximum movement permissible for good, clean work.

This, in the case of a 5 x 4 camera, with a 6-inch lens, would be 600 inches or 50 feet. Divide the number of seconds in an hour by the speed per hour in inches, at which the object is travelling.

This will give the fraction of a second at which the shutter must be run, in order to ensure a movement of not over one inch in the subject.

Take the example of a bicycle being ridden at ten miles an hour, at right angles to the camera.

3,600 = number of seconds in an hour, and 10 x 1760 x 36 reduces the miles to yards and inches. We therefore have

$$\frac{3,600}{10 \times 1,760 \times 36} = \frac{1}{176} \text{ of a second.}$$

This, however, is not fast enough to get the upper spokes sharp, for the reason that there is the forward movement of the upper spokes, which, when a wheel is running on the ground, has to be added to the speed at which the machine is travelling, and a considerable increase in the shutter speed would be necessary in order to get these spokes sharp. This, however, is unnecessary, as the slight movement in them adds to the idea of pace.

The backward movement of the lower spokes discounts the speed of the bicycle, and these will therefore appear quite sharp.

Now take the case of a steam launch, going at eight miles an hour,

$$\frac{3,600}{8 \times 1,760 \times 36} = \frac{1}{140} \text{ second,}$$

the shutter speed required.

The Thornton-Pickard method gives the same result, and is evidently based on the permissible movement I have named.

In using it, you divide the distance of the subject in inches, by the speed in yards per hour at which it is going, multiplied by the focus of the lens.

Thus the rule applied to the last example is

$$\frac{50 \times 12}{8 \times 1,760 \times 6}, \text{ or } \frac{1}{140} \text{ second.}$$

This is, if anything simpler. All this is plain sailing enough. Having these simple methods in mind for determining the necessary speed (and it must be borne in mind that by using the first method double the speed must be given for half the distance, or half the speed for double the distance), the next thing essential to success is to have a thorough knowledge of the powers of one's shutter, so that the methods may be properly applied.

A simple apparatus may be constructed at the cost of a few shillings, which, to the man who loves absolute accuracy, will be a joy for ever.

Go to a bicycle repairer and buy an old wheel, preferably with a wooden rim, and have the spokes trimmed up so that it runs perfectly true.

You should be able to buy this for 5s. or 6s. Now fasten several boards together, to get a square of three feet, and to the centre of this fix a two-inch deep block, into which a nut has been sunk, taking the thread of the wheel axle.

Into this nut tightly screw the wheel and adjust the cones, so that when the board is placed against a wall the wheel will run freely and easily for several minutes.

Now, with a compass saw, cut a circular band of wood, about three inches wide, which will just fit round the wheel rim, leaving about ¼ inch of play.

You can make this out of half-inch pine boards, by laying several of them together, and marking the inner and outer circles, then each board can be cut separately, and after all are cut the circle can be nailed together by small strips at the back.

This circular dial must be painted a dead black with Nigrogene or some other such compound, and be divided up into a hundred spaces of equal area. This is the most difficult part of all, but by carefully measuring both the inside and the outside, and then going round with your compasses you will soon adjust them so as to get the divisions exact. When you have thus marked the inner side of the dial, then measure and mark the outer edge of it, and draw thin pencil lines and connect the corresponding dots. Now cut thin strips of white paper, not over 1-32 inch wide, and carefully gum them down on to the pencil lines.

You have now a beautiful black and white dial of 100 equal divisions.

By means of supports placed underneath this dial it must now be firmly fixed to the large three-foot board, so that it just fits round the bicycle wheel; but the rim of the latter must project a little above it, say, ¼ inch.

Now get half a dozen or so of long fine needles, and drive them into the wooden rim at about equal distances round it. If the rim is steel, you can solder the needles to it.

These needles should move just over the surface of the dial, when the wheel is revolved.

There is only one thing more. On to one of the spokes stick a small piece of paper, which, every time the wheel revolves, will strike a nail, which you will place in the board behind it.

This will make a distinct sound, but will not interfere with the free running of the wheel.

Your speed tester is now complete. Stand it against a wall, in bright sunshine, and each of the needles will reflect a narrow streak of light against the black dial.

Focus on the dial so as to get it as large as possible on the plate. (It is a good idea only to take in the upper half of the dial.)

Now revolve the wheel and let it run until the paper sounding against the nail shows that it is making exactly one revolution per second. (A good ball-bearing wheel should do this for several seconds consecutively before it begins to slow down.) Then make your exposure.

On developing the plate the needles will be found to have left dark patches against the dial, according to the distance they have moved during exposure.

If the movement is equal to one of the divisions the exposure was 1-100 sec.; if two divisions, 2-100 sec. or 1-50 sec.; if ¼ of a division, 1-400 sec.; if 1-10 of a division, 1-1,000 sec.; and so on.

You can measure results with absolute accuracy down to 1-2,000 of a second.

This machine has demonstrated to me some curious facts about the action of a focal plane shutter.

Accordingly as the slit moves against or with the movement of the needles, and therefore of the subject, the effective exposure on the moving object itself varies greatly.

The great advantage of this simple machine over any others that I know of, is that by placing a number of needles round the rim, the action of the shutter for every kind of movement is found at one exposure, thus saving many plates and much time.

The movement of the needle on the right side of the plate will be quite different from that on the left side, because, in one case, the slit ran against the needle movement, and in the other case with it. With a narrow slit at low tension this is very marked.

For all practical purposes it is quite sufficient to take the record of the top needles.

It is usual for a focal plane shutter when in the camera to run down the plate from top to bottom. This is as it should be. Take the case of a man diving. When the shutter runs down the plate it is going in the opposite direction to the movement of the figure, but if the blind be run upwards the effective exposure on the figure itself is enormously reduced, though the exposure for stationary objects in the picture does not vary.

Likewise, when an object is rising rapidly from the ground, it is going in the same direction as the slit (on a top to bottom blind), whereas any falling object, like a diver, goes against it.

Movements from right to left, or left to right, make no difference, but if the camera be fitted with a reversing shutter, instead of a reversing back behind the shutter, exposure is complicated on rapidly moving objects when the picture is made vertically.

With a shutter running from side to side of the plate an exposure which would be adequate for a racehorse going against the movement of the slit, might be quite inadequate if he was going *with* the slit.

I do not consider the principle of the reversing shutter is as good as that of the reversing back behind the shutter, as on a vertical picture of a very rapidly moving object it is necessary to arrange matters so that the slit moves against the subject, and thus you have another thing to think about, and if a mistake be made the plate may be lost by movement.

The reversing shutter perhaps has one advantage, in that the plate can be brought a trifle nearer to the blind, and also that it can be arranged to run up the plate as well as down if required.

It is very seldom, however, that one has to photograph an object rising rapidly from the ground, as compared with the frequency one wants to photograph a falling object.

Moreover, an object, such as one might desire to photograph, seldom rises from the ground with the same rapidity that it descends to it.

The falling shutter is therefore correct in principle for the majority of subjects.

This machine will clearly prove how wrong a very narrow slit at low tension is in principle.

Some of my tests show the spokes of the wheel curved fully 4 inches when a $\frac{1}{8}$ inch slit at low tension was used.

I am, unfortunately, unable to illustrate this article from my numerous experiments, as I am writing it in Japan, and my results are all in California

A USEFUL ADDITION TO ANY CAMERA FRONT.

By. J. T. Hackett.

I have no doubt that many photographers besides myself possess a camera that will not shut up close enough to the ground glass when a very short focussed or wide-angle lens is screwed into the flange attached to the outside of the camera front in the usual way, but have found that if the flange is screwed upon the inside of the front of the camera, and the short focussed lens then screwed into it, so as to be inside the camera, that the camera will then shut up close enough to focus the picture properly on the ground glass. But then another difficulty presents itself, viz., how is the lens to be covered and uncovered in order to expose the plate without fogging it? By the arrangement I am about to describe it will be easy to use either a lens cap, or any form of time or instantaneous shutter that can be fitted to any lens hood or tube. I make a wooden or metal ring (similar to the hood of a lens) on which a lens cap or a time and instantaneous shutter can be fitted as easily, and in the same manner, as to a lens hood or tube. The flange of the lens is screwed into this ring. Sometimes when the lens is screwed on from the inside of the camera it will be necessary to screw the flange upon the inside of the rising front of the camera. But this is not often necessary, because, by chamfering the wood away a little with a sharp penknife around the inside of the opening through which the lens looks, it will be found possible to screw the lens upon either the outside or the inside of the camera, as may be necessary, without having to shift the lens flange to the inside of the camera front. I made the ring for my camera of wood, thus: Select two pieces of mahogany, cedar, or other suitable wood, about a quarter to three-eighths of an inch in thickness, and about a quarter of an inch wider each way than the diameter of the ring is to be; then glue together in such a way that the grain of one piece crosses the grain of the other piece, and place the whole upon a sheet of plate glass (or other flat surface) under a heavy weight for twenty-four hours or longer, in order that it may become perfectly dry. Then with a pair of compasses draw two circles upon it, one circle being as large or nearly so as the size of the block of wood will allow, and the other circle about half an inch less in diameter than the first circle drawn. Now cut out carefully all the wood within the smallest circle, by the aid of a brace and centre-bit, and a sharp chisel and penknife, after which, cut away the wood outside the largest circle with a saw, chisel, and penknife. The result will be a ring of wood, which is now glued and screwed to the outside of the camera front. Four holes must be bored in the ring at equal distances apart. These holes had best be bored before the ring of wood is cut out, as then there should be no fear of splitting the wood, if a sharp bradawl is used with care. The polish should be removed from the camera front with sandpaper at the part to which the ring of wood is to be glued and screwed, otherwise the glue will not stick properly to it. The ring of wood is now blackened on its inner edge with Stephen's blue-black writing fluid, or other black stain, and the outside of the ring is french-polished, or varnished with shellac varnish.

THE MANAGEMENT OF REMBRANDT LIGHTING.

By Practicus.

The term "Rembrandt" lighting was applied by someone at some time who had a very incomplete idea of the special character of many of the portraits produced by one of the greatest of the world's painters. A picture may have a preponderance of shadow, the high lights being few and forcible, or it may have a preponderance of lighter tones with darker notes of emphasis. The greater number of Rembrandt's pictures are characterised by strong shadows, and small areas of brightly lit portions of the subject. The photographer when he speaks of a "Rembrandt" lighting, too often thinks of a head turned sideface, with a strong light thrown on the profile, and the rest of the face and figure almost detail-less, a dark solid mass. This is precisely what a "Rembrandt" portrait should not be. Dividing the lightings of a "Rembrandt" character into three sub-headings we may consider full or nearly full-face portraits with a strong illumination from the side, side or nearly side-face portraits, with the face looking more or less towards the source of illumination, and quite side-face portraits in which the whole of the face is in shadow, the profile being outlined only, this style of lighting being sometimes called "line lighting."

There are certain defects common to all these styles which unfortunately exist with only too great frequency. The tendency is to employ much too strong a light, with, as a natural consequence, too great a contrast in the subject. The high lights of the negative are thus fully exposed, and are very dense on development without the shadows being sufficiently exposed. Or, per contra, if the shadows are exposed the high lights on solarised and all proper modelling is lost. As a rule, even if the lighting is sufficiently soft in character, the negative is very much over-developed, and has harsh printing contrasts. Again, the face is usually turned towards a strong light, with the result that the reflexes in the eyes are too large, and need scraping down in the negative, a very critical piece of work, and one calculated to destroy proper expression. Further than this, the strength of the light causes the pupils to contract, and the actual expression is not so good as when the pupils are larger or more dilated.

Let us see then how these defects may be avoided and how the desired effects may be obtained with the greatest economy of time. Taking the full-face, or nearly the full-face portrait first, we place the sitter in the normal position in the studio, and light the head so as to secure a nicely-rounded lighting with soft transparent shadows, keeping the reflexes equal in both eyes. Now place over the head more towards the shadow side an opaque head screen, watching carefully the result, which should be that of increasing the area of the shadows, and so conveying the effect of more forcible illumination of the head as a whole. If the original lighting has any tendency to flatness, that is, if there was too much light admitted from top and side towards the front of the sitter, the blinds here must be closed. If the lighting is the normal 45 degrees from top and front, however, the opaque head screen should do all that is necessary in the way of increasing the area of shadow. Of course, a somewhat dark background will be used, and it may be pointed out

that if the background is gradated, the dark portion coming against the light side of the head, and vice versa, the result is to accentuate the effect of contrast, to make the lights more forcible and the darks more rich, while at the same time the actual contrast is not increased, but is kept within the compass of the plate, and the shadow detail will be recorded before the high lights are over-exposed. A moment's consideration will show the worker that this is the principle on which to work, for in the normal full face lighting we have the high lights strong enough, and the shadows dark enough. All that is needed for the production of the Rembrandt effect is to get a smaller area of light and a larger area of shadow, and this is most easily effected in the way suggested. It will be noticed that this method pre-supposes the ability to light a head well in what may be called the normal way, and, of course, also assumes that the lighting in the studio is properly under control, and that the studio is not flooded with light from every direction.

Two alternative methods may be given for obtaining this same effect, in each case starting with the normal full-face lighting as the basis. The one method is to turn the head a little further from the light, that is, more towards the three-quarter face position, and then move the camera further to the side, so as to obtain again a full-face view of the head. The second method consists in bringing the sitter nearer to the camera until the proper effect is secured, and then, of course, drawing the camera back also so as to get the image on the ground glass of the proper size. An objection to both of these alternative methods is that the character of the lighting is more distinctly side-lighting, and this does not give so good a modelling, in some instances conveying a swollen appearance to the cheek or neck.

We may now proceed to the second type, the head photographed side-face looking towards the light. Again, the simplest method of procedure is to light a full-face portrait in the normal way, taking care that the reflex shows equally in both eyes, but only just in the eye on the shadow side of the head. Now, without moving the sitter, wheel the camera round so that a side or nearly side-face view of the head is obtained, and it will be found that the effect of light and shade is almost if not quite satisfactory. It may be that the shadow will prove a trifle lacking in transparency, and should this be the case a reflector of gray calico may be placed as near the camera as possible so as to avoid any danger of cross lighting. If this reflector be a frame covered with canvas, papered white, the device originally adopted by Mr. Henry Van der Weyde may be used, a hole being cut in the reflector on a level with the camera, and the lens then pointed through this aperture. This method gives a soft illumination of the shadows with the risk of cross lighting reduced to the minimum. Of course, this method of obtaining side-face Rembrandts necessitates a studio of considerable width, and as this is by no means a general condition of things, it cannot be so often employed as might be desired. The following method then will be that most generally useful. Open about four feet of side light at the extreme end of the studio, the end occupied by the sitter, and about as much of the top light, taking care that the general angle of illumination is 45 degrees. Avoid too low a side light, which is apt to glare into the sitter's eyes, producing the excessive reflexes

referred to, and avoid also too direct a top light, which causes the hair to be much too white. If the blinds cannot be arranged without excess of top light a translucent head screen must be used to soften the lighting. Now place the sitter somewhat nearer to the camera-end of the studio than the open glass, so that the lighting is from the side, but rather behind the sitter. On turning the head towards the glazed side of the studio it will be found that the eyes are not looking to the open glass, but at the contained portion of the window, and if the photographer places himself in front of the sitter, at P., Fig. 2, getting a full-face view, he will find the lighting is practically a normal full-face lighting. Now, with the camera getting a side-face view of the sitter, and the reflector arranged so that the lens looks through it or just past its edge, a good Rembrandt lighting will be obtained. In order to make this more clear, two diagrams showing the floor of the studio, and giving the positions of sitter, camera, and window, have been prepared. Fig. 1 shows the

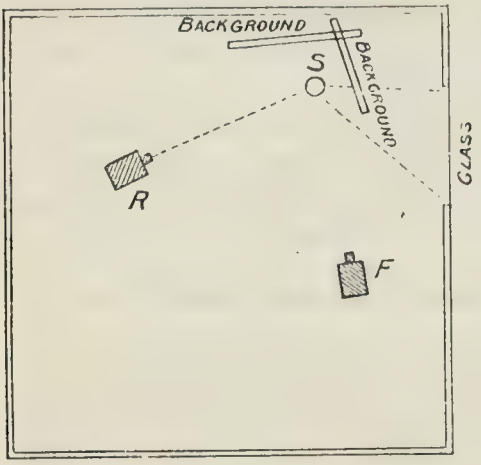


Fig. 1.

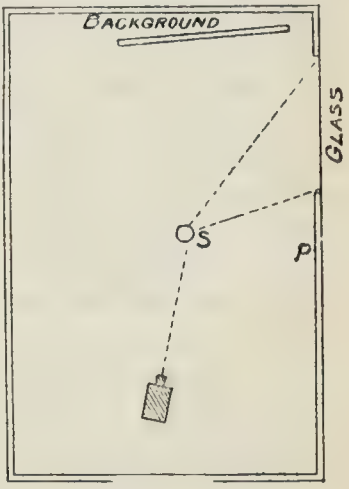


Fig. 2.

normal full-face lighting when the camera is at F, and by placing the camera at R, the studio being a wide one, the Rembrandt picture is secured. Fig. 2 gives the positions in the narrower type of studio. The relative positions of glass, sitter and camera in the two methods will be found very similar. It must not be supposed that all that is necessary is to chalk one or other of these diagrams on the studio floor, and then after placing the sitter to make the exposure. Some little modification either in the strength or direction of the light is almost sure to be needed, and, of course, much depends on the character of the face under consideration.

We are now left to consider the line lighting, which is, perhaps, the least used of the three types. Only the most perfect and refined profiles will bear this treatment. The effect to be aimed at is a shadow filled with soft delicate detail, while more or less all round the head is a line only of light. On the hair the light may not be quite so pronounced. To produce this effect the light must be almost exactly behind the sitter, and as the background, if too

large or too near, would cut off all the direct light, it becomes necessary to keep it well back from the head, and to use a back light in which top light predominates. Care will be needed to prevent light striking into the lens, and here, again, the reflector, through which the lens looks, will prove a valuable adjunct, for in addition to softly illuminating the shadows, if properly arranged it will prevent any light other than that from the subject reaching the lens. One of the causes of frequent failure when employing this method of lighting is the placing of the model too near to the light. A large dark background at a good distance and the sitter well in front of the light will give the most pleasant effects.

It may not be inappropriate to add a word or two on the development of plates exposed under the conditions considered. A perfect piece of lighting may be spoiled in its rendering if the plate is badly developed. The usual mistake is over-development. These Rembrandt lightings are almost invariably taken with dark backgrounds, and a negative so produced needs less development than one of a normal vignette head, against a light grey background. Either the normal developer may be used and the time of the development shortened by about 25 per cent., or the developer may be diluted by the addition of, say, half its bulk of water, and development carried on for about the normal time. In any case, prints should be carefully examined, and if there is any lack of gradation in the highest lights by the time the shadows are deep enough, it may be taken as an indication to soften the lighting, or if that be sufficiently soft, to keep the negatives less strong in contrast by one or other of the methods indicated.

THE CHEMISTRY OF THE SULPHIDE TONING PROCESS.

By Douglas Carnegie.

So far as I can ascertain, the chemistry and *modus* of the now popular process of sulphide toning of bromide prints has received but scant attention.

During the past summer I have been working on this process, and as it will be some time before I can command the leisure to continue my work, I thought it would be well to put on record the progress so far made.

The Bleaching of the Print.

As a bleaching agent I have used in my experiments a solution made by dissolving 9grs. each of ammonium bromide and potassium ferricyanide in 250 ccs. of water. This is practically the recipe given in the "B.J. Almanac." To save words, I shall henceforth refer to this solution as "the bleach."

A bromide print immersed in this solution is bleached almost instantaneously. As is well known, a print will bleach in a solution of potassium ferricyanide alone, but the bleaching takes place so slowly that an immersion for several hours is necessary for its completion, and, it may be added, the tones obtained by sulphuretting prints thus bleached are, so far as my own tastes in matter of tone are concerned, quite impossible. As Eder showed some years ago, the reaction which takes place when metallic silver is brought into contact with potassium ferricyanide solution may be expressed by the equation—

$$Ag_4 + 4K_3FeCN_6 = Ag_4FeCN_6 + 3K_4FeCN_6.$$

How is the extreme slowness with which a print bleaches in pure ferricyanide solution to be accounted for? May not the following observation furnish the clue to the answer? When potassium ferrocyanide solution is added to an excess of silver nitrate solution the precipitated silver ferrocyanide is flocculent, settles rapidly, and is easily washed in a filter or by decantation. But if the silver salt is not in excess the silver ferrocyanide is precipitated in a sticky, slimy form, which, on account of its coherence and impenetrability, it is next to impossible to wash in a filter even when using an efficient filter pump. Now in the bleaching of bromide prints we have silver ferrocyanide formed in the absence of any soluble silver at all, and presumably under these conditions the silver ferrocyanide takes the form of the slimy impenetrable modification just described. The formation on the surface of the silver image of a thin coating of this almost impervious variety of silver ferrocyanide would clearly prevent the rapid conversion of the underlying body of the silver image.

The question now presents itself why the addition of ammonium bromide to the ferricyanide solution so greatly accelerates the process of bleaching. The answer, I take it, is as follows: The ammonium bromide interacts instantly with the slimy deposit of silver ferrocyanide initially formed, giving as the result of the interaction a product which is readily permeable to the bleaching solution. Another lower layer of silver is rapidly converted into silver ferrocyanide, which is instantly acted on by the bromide, permitting of the ready access of the bleach to still lower strata of the silver image. And thus the bleaching is rapidly completed by an alternation of two separate and independent reactions.

If this view of the matter is correct it necessarily follows that rapid bleaching should result from the alternate immersion of the print in pure solutions of potass ferricyanide and ammonium bromide respectively. This I find to be the case. A print was dipped for an instant into potass ferricyanide solution (of the same concentration as the bleach) thoroughly washed, and then submitted to a bath of ammonium bromide. Again, the print was washed, returned to the ferricyanide bath, washed, returned to the bromide bath, and so on. Deducting the times required for the intermediate washings, a print thus treated was found to bleach in practically the same time as would be required by the bleach made by mixing the two solutions of ferricyanide and bromide. The final tone of a print bleached by the intermittent method is the same as that of a print treated with the usual bleach.

The next point to be cleared up is this: What is the nature and composition of the product of the interaction of silver ferrocyanide and the ammonium bromide solution? In other words, what is the composition of the final product in the bleached image? It seems to be generally assumed that the final result of the bleaching is the conversion of the silver image into ordinary silver bromide AgBr. I think I have proved that this view can no longer be retained.

However long a print remains in the bleach, it is never, literally speaking, bleached. The "bleached" image is always clearly discernible, and has a pronounced brownish hue even when the

bleaching operation has been conducted in non-actinic light. But ordinary silver bromide is not brown. If a bromide print is bleached in bromine water (when undoubtedly ordinary silver bromide must be formed) the print is literally "bleached"; it is quite impossible to discriminate between the white image in silver bromide and the white paper which supports it.

Again, a print bleached with the bleach in darkness is readily redevelopable by any of the ordinary developers. But a print bleached with bromine water in darkness must first be exposed to light before it can be redeveloped.

From these two considerations alone it is clear that the bleached bromide print cannot consist of ordinary silver bromide. Of what, then, does it consist? I believe of a hitherto unrecognised sub-bromide of silver, which for the present I propose to distinguish by the non-committal title—the puce-coloured bromide of silver.

Pure, finely-divided silver was prepared by adding ferrous sulphate solution to silver nitrate solution, and then treating the precipitate with dilute acid, and finally washing it. A known weight of this silver was shaken up with the bleach in a stoppered tube. The ferrocyanogen content of the bleach was determined before and after the treatment with silver.* It proved to be practically the same after treatment as before. Hence I was forced to the conclusion (quite contrary to the expectations and bias I entertained before actually starting my experiments) that no ferrocyanogen is present in the deposit constituting the bleached image. The deposit must therefore necessarily consist of silver and bromine only.

The puce-coloured body into which the silver is transformed by the bleach was thoroughly washed, dried at 100 deg. C., and weighed. It was then treated repeatedly with warm dilute nitric acid to remove any unconverted silver that happened to be admixed with it, and again washed, dried, and weighed. Thus I was enabled to determine the percentage of silver in the body, and this I found to be some 61 per cent. Since ordinary silver bromide contains only 57.4 per cent., it follows that this puce-coloured body must, in conformity with the usages of chemical nomenclature, be regarded as a form of sub-bromide. The puce-coloured bromide prepared as above described has a very high density, sinking in water as rapidly as the silver from which it was formed. It is, like silver bromide, easily soluble both in potassium cyanide solution and in hot solution of mercuric nitrate.

So far, I have made only two preparations and two anaylses of this bleach product, and in both analyses only the percentage of silver was determined directly—the percentage of bromide being estimated by difference. I purpose, when the occasion offers, to

* It may be well to give the outline of the analytic method adopted in this connection. Equal volumes of fresh bleach and of bleach in which metallic silver had been digested were treated with excess of NaOH, boiled, and while boiling reduced from the ferricyanic to the ferrocyanic condition by the addition of ferrous sulphate. The reduced solutions were made up to equal bulk and aliquot portions filtered off and titrated with a standard solution of copper sulphate, using filter paper slips dipped in ferric chloride as indicators of the end of the titration. Equal volumes of the $Cu\,So_4$ solution were required both in the case of the fresh and used bleach, showing that the insoluble silver compound formed has no ferrocyanogen content.

repeat the analysis with greater care, varying the methods of procedure and making direct determinations of both the silver and the bromide.

To sum up, I conclude that the bleached image consists of a dark puce-coloured sub-bromide of silver, and that hence results the visibility of the "bleached" image.

The puce-coloured bromide would seem to be more readily dissolved by alkaline bromides (potass. and ammonium bromides) than is the ordinary bromide of silver. For if two slips of the same bromide print A and B are bleached, A in potass. ferricyanide containing a fair excess of ammonium bromide, B in bromine water containing the same concentration of ammonium bromide, and the slips are then sulphuretted, it is found that the image of slip A is ever so much more reduced in intensity than is that of slip B. Indeed, an over-developed bromide print may very successfully be reduced and toned at the same time by increasing the amount of bromide in the bleaching bath prior to sulphuretting. In general it may be stated that the greater the concentration of the bromide in the bleach, the colder and more purple is the resulting tone, and the fainter is the picture.

In this connection the point arises whether there is not an unnecessary excess of bromide present in the empiric recipe for the bleaching solution given in the "Almanac." The molecular weight of ammonium bromide is 98, that of potass. ferricyanide is 329. Even if ordinary silver bromide (and not the puce-coloured sub-bromide) were the final product of the bleach, its indirect formation via ferricyanide would demand the presence of only one gramme-molecular weight of NH_4Br to each gramme-molecular weight of potass. ferricyanide. Whereas the bleach made up according to the recipe contains about 3.6 gramme-molecular weights of ammonium bromide per one gramme-molecular weight of potass. ferricyanide. This apparently unnecessary excess of ammonium bromide may (in view of the susceptibility of the puce sub-bromide to the action of alkaline bromides) have a deleterious reducing effect on the faint details of such prints as, prior to toning, are not over dense, but exhibit a satisfactory depth and range of gradation.

It will be noted that I do not yet venture to give the equation showing the *modus* of the formation of the puce sub-bromide from the interaction of the ammonium bromide and the silver ferrocyanide. Much quantitative analytic work must still precede the writing down of such an equation. But it may be of interest to note in passing that I find that alkaline bromides do *not* produce this insoluble puce-coloured body when, in the absence of any metallic silver, they interact with the bluish ferrocyanide of silver prepared in the ordinary way by double decomposition between a soluble silver salt and a soluble ferrocyanide. The interaction between soluble bromides and ferrocyanide of silver thus prepared is an exceedingly complex one, but is of purely chemical rather than of photographic interest. Suffice it here to say that so far from an insoluble silver bromide being the end result, complex cyanogen compounds of silver, both soluble and insoluble, are formed.

It should be noted that the chemistry of the bleaching process here described is of interest and importance, not only from the standpoint of the toning of bromide prints, but also from the standpoint

of the production of carbon prints from bromide prints by Mr. Manly's new and elegant ozobrome process.

The Sulphuretting of the Bleached Image.

It is generally taken for granted, I believe, that the sulphuretting of the bleached image converts it into ordinary sulphide of silver—silver sulphide. It has always seemed to me, however, that the correctness of this assumption is *a priori* improbable. For ordinary sulphide of silver is, to use a colloquialism, "as black as one's hat," whereas the finished toned image varies in hue from brown to sepia. Of course, there is the probability of the dichroism of silver sulphide—a substance which in bulk is black—might in thin layers be brown or sepia coloured. But I believe I have sufficient proof of the correctness of my *a priori* conclusion that the toned image does *not* consist of ordinary silver sulphide.

As a sulphuretting agent, I originally made use of the solution of sodium sulphide, of the concentration recommended in the "B.J. Almanac." But I soon abandoned this solution on account of its poor keeping qualities. The sulphuretting solution which I chiefly used, and which I would recommend to the notice of sulphide toners, was a solution of the sulphydrate (and not the sulphide) of sodium. This solution I prepared in the following way. Six grammes of caustic soda were dissolved in 250 ccs. of water, and the solution was divided into equal portions. One portion was saturated with well washed hydrogen sulphide, and then added to the untreated portion. A solution so prepared can be used over and over again, and keeps its virtue perfectly for at least six months. Sodium sulphide solution of the strength usually recommended is completely decomposed and worthless for toning purposes in three or four days. In addition to its stability, the sulphydrate solution also possesses the great recommendation that it has a barely perceptible smell of hydrogen sulphide, so that it may be used in the laboratory or studio without annoyance. When, however, the toned prints are submitted to the action of the wash-water, there is a considerable evolution of hydrogen sulphide from them, and therefore it is advisable to conduct the washing out of doors, or at any rate in a room where fumes of hydrogen sulphide can do no damage to man or material. The tones given by this sulphydrate solution have a pleasing purplish tinge, and it seemed to me (though I would not venture to dogmatise on the point) that this solution does not choke up the heavy shadows in the picture to the same extent that ordinary sulphide solution is well known to do.

What, then, is the nature of the brown or sepia coloured body formed in the sulphuretting bath? I believe it to be a gelatino-sulphide of silver, probably approximating in its character to the probalbates and bysalbates investigated by Paul and Voss. (Abstracts, Chemical Society's Journal, 1902.)

I find that when silver bromide emulsified in gelatine is made slightly alkaline and then treated with hydrogen sulphide, black silver sulphide is not precipitated, but a dark room opalescent liquid results, which passes through the blue ribbon brand of Schleicher and Schüll's filter paper. (The blue ribbon brand of filter is guaranteed to strain off the finest and most refractory precipitates met with in

analytic work.) Or, again, if plates which have been exposed, developed to the utmost, and then submitted to sulphide toning in the usual way are treated with boiling water, the same brown opalescent solution, from which no solid can be filtered off, is obtained. This brown "solution" of gelatino sulphide of silver is not affected by large dilution, nor is it in any way coagulated or precipitated by the addition of either alcohol or neutral salts. (On long standing, however, it deposits small quantities of a dark brown solid.) Hence, I infer that it is not an ordinary colloidal solution, but that it is in all probability an exceedingly fine emulsion of extremely small solid particles—that it is, in fact, a quasi-solution of the type studied by Picton and Linder. (Chemical Society's Journal LXI.) If this is the correct conclusion, the very finely divided suspended solid would probably be separable by filtration under pressure through a biscuit-ware porous cell, and the "solution" itself should be capable of polarising light. These possibilities will be made the subject of further investigation.

The brown "solution" of gelatino sulphide of silver is decomposed when boiled with nitric acid, a light khaki-coloured precipitate being thus thrown down. This precipitate contains both sulphur and silver, since when treated with a mixture of hydrochloric acid and potass chlorate, silver chloride is formed, and the filtrate gives the SO_4 reaction with a solution of barium salt; it is, therefore, some new form or new modification of silver sulphide.

I have seen it stated somewhere that bromide prints which have been thoroughly dried are not amenable to the sulphide toning process. My own experience renders it difficult for me to conceive how such an idea could ever have arisen. For most of my experiments have been made with prints of several months' age, and I have never met with a single case of refusal to tone.

In the course of my experiments I have tried various suggestions that I have seen made with a view to increasing the transparency and detail, rendering in the heavy shadows of toned prints by means of water-lac varnishes. My experience is that very little, if any, virtue lies in these suggestions. A diluted spirit varnish undoubtedly does clear up and brighten the picture, but it is difficult to apply this varnish so as to show no streakiness. If bright, transparent, toned prints are desired, it seems to me best to use papers of the enamo type. In conclusion, I may state that all my work has been carried out with only one make of bromide paper—the Wellington.

PLATES FOR HAND CAMERA STEREOSCOPY.

By Chas. Louis Hett.

In last year's Almanac I mentioned the new postcard plate as being suitable for the above purpose. I made a new camera to suit this, and have tried it this season. I still think that the size of a postcard—viz., 5½ inches by 3½ inches, is very suitable for the finished size of a stereoscopic print; but it is too small for the negative. If printed on postcards, unexposed margins show on edges. In order to obtain sufficient latitude the plate should be

about 5⅞ inches x 3⅞ inches. In fixing a new size of plate it is to the interest of both plate and apparatus manufacturers that such size should be cosmopolitan. I therefore advocated the use of a plate 15 cm. (5⅞ inches, rather over) by 10 cm. (3 15-16 inches). This is a matter worth very serious consideration. There are no existing apparatus or dishes to hamper the selection; the plate has only to be suitable for postcards, and in other respects generally convenient.

If any reliable firm will undertake to place this size on the market I will make a new camera to suit them, and report on their use another year.

ON REGISTERING AND NUMBERING NEGATIVES FOR FUTURE REFERENCE.

By Joseph Smith.

A good plan is to use up dry plate boxes for this purpose, placing twelve negatives in each, using the transparent parchment envelopes or negative bags, naming the negative with sitter's name, and number of negative, which can be plainly seen on holding the bag up to the light. This saves the trouble of writing on the bags. Only two reference books are required, one for cabinets and one for cartes, arranged as follows:—

		No. of Box, 1.
Name of Sitter.	Description of Negative.	No. of Negative.
Jones.	Bust vignette.	1,000.

No. 1,000 to 1,011 in No. 1 Box, No. 1,012 to 1,024 in No. 2 Box, and so onwards. Each negative box is numbered also to correspond with the numbers in the books, Nos. 1, 2, 3, 4, and upwards, with number of negative also. No. 1,000 to 1,011 to No. 1 box, No. 1,012 to 1,024 No. 2 box by gumming a piece of white paper on the box, and writing the same in ink. This system commends itself as simple in the extreme, and works without a hitch; also it is a good way to use up spare dry plate boxes. The same should be placed, when filled with negatives, on edge, and not flat; by so doing you prevent risk of breakage. By following this system negatives can be found in a few minutes which may have been taken and stored away for years, and to save endless time and worry in looking them up. Give this system a trial, and I feel sure you will be pleased with the results.

TWO PINATYPE MODIFICATIONS.

By E. Grills.

Instead of making the first printing (blue) by the pinatype process, an ordinary bromide print on thick glossy paper (Lumiere Mark "C," for example) is made, developed very grey (avoiding density), and after fixing and washing converted into an iron (blue) print by toning with the formula:—

Glacial acetic acid	1 oz.
Ammonio-citrate iron, 10 per cent. solution	½ oz.
Potass. ferricyanide, 10 per cent. solution	½ oz.
Water	12 oz.

After washing to rid of yellowness in the high lights, the next

pinatype printing (yellow) can be proceeded with, the subsequent operations being now similar to Pinatype, but the transferring will take a little longer time owing to the dye stuffs having to get through the iron deposit into the paper. It will give very good results, however, and the advantages will readily suggest themselves.

The second modification is of principal value when a subject has a host of subdued and neutral tones in it. Then I resort to the expedient of a fourth printing. When making the three-colour negatives, I make another extra one on a highly colour-sensitive plate (Wratten's Panchro gives a good result), using a colour filter, however, for this plate to give me a good monochromatic rendering of the subject. I make a weak grey print on thick glossy bromide and print the three pinatype colours on it. By this method the neutral grey tones are better rendered and it gives one much more control in printing deep-coloured shadows such as is met with in oil paintings, etc.

There is just this to be remembered—the bromide paper must, in both instances, be soaked for two minutes previous to exposure to take out the stretch; and as the exposure is made while the paper is wet it is obvious that the negatives must be previously varnished with a waterproof (celluloid) varnish. In making the prints, nothing of the nature of a hardener (such as an acid fixing bath) must be used, or else the dyes will not be imbibed, and so spoil the print. Very little experience is necessary, and it certainly should be tried.

FEWER BRANDS OF PLATES.

By Alfred Watkins.

There are few commercial considerations more serious to a photographic dealer than the increasing number of brands of plates which his customers desire him to stock, especially as each brand is not confined to one size, and it is important not to keep rapid plates long in stock. I am strongly of opinion that makers have allowed the number of their brands to increase beyond the wants of the public, and that greater simplicity in this matter would ultimately be to their advantage.

I consider that three rapidities of negative plates (besides the Iso brands) are ample. There is no need for a difference in speed smaller than 100 per cent. between different brands, and at present almost all makers issue brands the differences between which are much smaller than 100 per cent. In fact, I have several times tested two brands of one maker, which proved in the photometer to be practically identical in speed, and as the image also appeared in the same time, and when developed for the same times, the steepness of gradation was identical, I found it difficult to come to any other conclusion than that one emulsion served for the two brands. Might I be permitted also a growl at the inconvenience of some of the names? Messrs. Wratten, for instance, issue "Instantaneous" "Drop Shutter," and "Speed" plates, all these names equally expressing rapidity. Old usage is no doubt the excuse in this case, but the same plea cannot be allowed to the Imperial Company, who

have recently issued two new brands of ortho plates of different speeds—viz., Ortho Special Rapid and Ortho Special Sensitive. Who on earth is to guess from these names which is the most rapid of the two brands?

Most makers are now alive to the necessity of marking the box itself (besides the wrapper), with name and brand, but I have occasionaly suffered the inconvenience—after tearing off and throwing away the outer wrapper—of finding a perfectly plain box, which bears no indication of either name or brand. Where a speed number is quoted it is often only on this outer wrapper, which must be torn off to get at the box.

CIRCULAR BELLOWS.

By G. W. Valentine.

Cut some lengths of fine brass wire, sufficient to make a circle of the diameter of bellows body required, and neatly join the ends by soldering. For a bellows body about one foot long twelve wires will be required. Obtain a piece of thin bookbinder's cloth, rather longer than the bellows body is required to be, and for the circumference allowing one inch at least for lap; glue the lapped edge and thoroughly dry. When dry, insert the brass circular wires into the bellows body, keeping them one inch apart, and fasten the two outside ones with pins, temporary, until quite dry. When quite dry, cover the bookbinder's cloth bellows body with thin morocco leather, or other thin leather will answer. Then between each brass wire circle, and whilst the leather is damp, tie a piece of string in between each wire, which will give you at once a capital bellows body without any fear of sharp corners to wear out, and when dry four strings will keep in proper shape.

THE POSING CHAIR.

By W. Foster Brigham.

What horrible memories that title would call to the mind of those who suffered under the hands of some of the earlier photographers. No wonder we hear the "dentist joke" (?) from ninety-nine out of a hundred sitters who, in their early days, have known the elaborate monuments to perverted ingenuity that appeared as helps for the portraitist. Let us hope that the newer generation will have no cause to make the same painful comparison.

The form that these marvellous pieces of cabinet making took was either that of a chair and head clamp combined, still used in some studios to this day, or they were provided with raising lowering, tilting, and swing motions, that recalled only too distinctly the plush cover hiding the steel mechanism of another piece of professional furniture of dreaded and dreadful memory.

That this latter type is not yet as extinct as might reasonably be expected, considering the enlightened methods now prevalent under the skylight, is proved by a photograph that recently appeared in the "British Journal of Photography," showing the interior of a studio, situated in progressive go-ahead America.

We trust that in this age it is unnecessary to once more appeal

for the banishment of all such trash in the name of all common-sense and natural photography. If it is, let us say once more throw out of your operating room, another heritage of the dark ages, any furniture that is not that of an unphotographic household. With four or five ordinary chairs of varied pattern, everything necessary for securing natural poses and expression is at hand. Straight-backed chairs, with very little, if any, slope to the back support, are the most useful for heads, and, indeed, most positions. The other kinds may feel more comfortable, but the photographic results of the positions taken in them is undignified and ungraceful.

When photographing the head only, the back should not be seen. This is easily managed if the body be posed full, but many of the most beautiful turns of the head are secured when the body is in three-quarter, side or back view, and in these positions the chair back would either entirely prevent the pose being made or it would show, and be ugly and obtrusive.

To obviate this, we use a square four-legged music stool, without raising mechanism. In many instances this seat is rather too high for the sitter, and a footstool is necessary. This, however, is an advantage, for it is an easy matter to supply a rest of exactly the right height by using one, two, or three large volumes. Moreover, by putting the rest under one foot only the position of the shoulder is altered without drawing the sitter's attention. Raising the foot usually lowers the shoulder on the opposite side. Some sitters, who are rather limp, must be carefully watched, or they will sink all of a heap, when they are debarred from the support of a chair back.

If one cannot get over this, they will be better taken standing, in common with a few other types of sitter. It is advisable, however, to place them behind a high-backed chair, upon which they can rest their hands, gaining support, and maintaining the same position, for a slight forward or backward movement of the head will spoil the focussing.

For three-quarter and full-length poses the arm-chair is generally preferred to the single. They must, however, be slight and unobtrusive. A saddle-bag or spring-upholstered chair is unsuitable. Only the seat should be stuffed, the back and arms being frame. When selecting the chair before exposing, see that it is of suitable height, the general fault being selection of a too low seat; that causes the sitter to have that limp, humped-up look we have referred to before. For child photography, smaller chairs should be available, the backs being the chief worry. A very narrow low back is alone serviceable. Seated on the head stool, these small sitters are apt to sink down and look humped-backed; for all that we use it more frequently than any other.

A useful dodge is to paint children's chairs with a brilliant enamel, say, light blue for light, and segral red for dark. The bright colours attract and please very small folk.

When two or three heads are to be posed we use a form or a small upholstered ottoman; there being no back or arms, the correct position of the bodies and the requisite proximity of the heads is easily obtained. For large groups, besides footstools and

the music stool, it is advisable to have something between the two. For this and many other purposes we find a square box, about one foot all ways, extremely useful.

A very effective accessory, that perhaps scarcely comes under the heading of this paper, is an imitation sloping bank. One foot from the ground where it touches the background, and merging into the floor about four feet from it, are good proportions.

If made ruggedly of papier mâche and covered with imitation grass, or painted to represent rock, it makes a suitable and natural seat for children, or it may be used for excellent and unconventional groups of grown-ups. Very many famous painters have made use of a sloping bank to produce taking poses, and many examples could be instanced. One that most photographers will be familiar with is the portrait of a child, by Sir Noel Paton, that is used as an illustration by the late H. P. Robinson in his "Pictorial Effect."

ON PHOTOGRAPHING INSECTS.

By F. Martin-Duncan.

A branch of natural history photography of very great interest, and considerable economic importance, is the photography of insect life, and it is one that is well worth closer attention than it has at present received.

There are many photographers interested in natural history, who every season add to their collection photographs of butterflies and moths, but very few appear to devote any very serious attention or labour to the subject—that is to say, to attempt to form a really perfect and complete series of photographs, which will show every stage in the life history of an insect, from the egg, through all the wonderful process of metamorphosis, to the perfect insect, with photo-micrographs to show the anatomical structure of the insect at different stages of its development and the remarkable modification of structure that takes place during its life.

To the successful production of such a series considerable time, thought, observation, patience, and ingenuity must be devoted. It is not a task to be lightly undertaken, or that can be accomplished haphazard fashion. It is for that very reason that I would most strongly commend it to the consideration of any would-be naturalist-photographer desirous, not only of gaining knowledge and insight into the wonders of Nature, but also wishing to improve in the manipulation of his apparatus and general technical ability. The photographer will find ere he has half accomplished such a task that he is working with an ever increasing interest and enthusiasm, that his hobby has taken a new lease of life, and is becoming absorbingly fascinating. There is nothing kills a hobby more quickly than a sort of half-hearted interest or to work at it in an aimless way, and it is particularly the case with photography, in which a certain degree of proficiency is nowadays fairly easily attained. Once that facility has been attained, photography, as a hobby, is very apt to pall, unless some definite programme is drawn up and carried out, which will call for experiment and open up fresh possibilities.

In trying to produce a series of photographs which will illustrate the life history of an insect, the subject must be kept under constant observation, so that one becomes perfectly familiar with all its characteristic movements and poses. Most insects have their foes, and these also must be watched for and photographed.

To obtain the best results it is absolutely essential to use orthochromatic plates, so that as truthful a rendering of colour values as possible may be obtained. Aim at full exposure, and develop slowly for the maximum amount of detail and gradation.

"DRY" STAND DEVELOPMENT?

By C. Grant Smith (Sydney, N.S.W.).

As there are probably many readers of the Almanac who have lost valuable photographs through extreme under-exposure, I should like to relate a peculiar experience of mine recently, especially as I have never seen any reference to a similar happening elsewhere. I took a couple of half-plate photographs in the garden one morning the following being particulars of exposure, etc.:—11.30 a.m., Ilford chromatic plates, Ross aplanat, *f*/16, two seconds exposure, with (x 4) Iso screen, slight haze. I took them to the dark room at once, but as forty minutes' development produced absolutely no sign of an image, I gave it up in despair, thinking that perhaps the focussing cloth had been covering the lens. I had some idea of being able to use the plates again, so rinsed them in clean water and left them in the dark to dry. I afterwards put them face to face in an old plate box and forgot all about them, till I came across the box two years afterwards. I was then surprised to find, on holding them up to the dark room lamp, that they were covered with faint markings, which could be plainly recognised on looking closer as various white flowers. I immediately put them into some developer, and was pleased to find that the image began to develop, and in an hour and a quarter they were ready for fixing.

Sceptics will say "bromide!" but I never use bromide, and have none about. The developer was Mr. Mudie Draper's pyro-soda formula, without the bromide, and I did not absent-mindedly use clean water instead of developer, or forget the pyro, as in that case no image would have been visible after two years' wait. We have heard of "dry agriculture" and "dry cleaning," but I think "dry" stand development for two years is something distinctly new!

EPITOME OF PROGRESS.

In the following pages will be found classified abstracts of papers, communications and articles relating to photography which have appeared in the British and foreign journals during the twelve months, October 31, 1905, to October 31, 1906. In the case of some foreign journals the issues appearing at the close of this "abstract year" may not have arrived in time for inclusion in this year's Almanac, which is made up for press November 1, 1906, but such cases are not numerous.

The scheme of classification, it is hoped, will be understood on reference to the general Contents, and a list of the journals abstracted, with the addresses of the foreign ones, will be found at the end of the "Epitome." In a number of cases where information additional to that given in the abstract has appeared in "The British Journal of Photography," a reference to issue and page has been given.

I.—GENERAL.

EVENTS OF THE YEAR.

1905.

Nov. 24 to Jan. 13, 1906.—Exhibition of work of the Postal Camera Club, at the R.P.S., 66, Russell Square, London.

1906.

Jan. 9.—Award of R.P.S. Progress Medal for 1906 to Dr. Janssen, "for his work in astronomical photography, his researches in reversal and other photographic investigations." A portrait of Dr. Janssen and a review of his work appears in "B.J.," Jan. 12, 1906, p. 24.

Jan. 13 to Feb. 3.—The third Scottish Salon, Dundee ("B.J.," Jan. 19, 1906, p. 53).

Jan. 19, to Mar. 17.—First exhibition of colour-photography in England, held at The British Journal of Photography Offices, 24, Wellington Street, London, W.C.

Feb. 5 to Mar. 31.—House exhibition at the R.P.S. of photographs by Alvin Langdon Coburn ("B.J.," Feb. 2 and 9, 1906).

Mar. 1 to Mar. 15.—Exhibition at the Photo-Club, Paris, of portraiture and landscape photography with anachromatic lenses ("B.J.," Mar. 9, p. 184).

Apr. 16 to May 26.—Exhibition of photographic portraiture by R. Dührkoop (Hamburg) at the offices of THE BRITISH JOURNAL OF PHOTOGRAPHY.

Apr. 5-6.—Convention of the Professional Photographers' Society of New York (reported in "B.J.," Apr. 27, 1906, and following issues).

Apr. 27 to May 7.—Fourth Northern Exhibition at Manchester ("B.J.," May 4, 1906).

June 15 to July 1.—Salon of the Paris Photo-Club ("B.J.," June 22, 1906, p. 486).

July 9 to 14.—Twenty-first meeting of the Photographic Convention of the United Kingdom, at Southampton, under the presidency of Mr. E. J. Humphery, M.A. The proceedings are reported in the "B.J." The 1907 meeting is at Hereford, with Mr. Alfred Watkins as President.

Sept. 14 to Oct. 27.—Fourteenth Photographic Salon, at 5A, Pall Mall East, S.W. ("B.J.," Sept. 21 and 28, 1906).

Sept. 20 to Oct. 27.—Fifty-first exhibition of the Royal Photographic Society. ("B.J.," Sept. 28 and Oct. 5, 1906).

The Selecting and Hanging Committee (pictorial section) were: W. R. Bland; Furley Lewis; G. A. Storey, A.R.A.; W. T. Greatbatch; J. C. S. Mummery, A.R.I.B.A.; and B. Gay Wilkinson.

The following were the judges in the technical section at the exhibition:—Thomas Bolas, F.I.C., F.C.S.; Douglas English, B.A.; Chapman Jones, F.I.C., F.C.S.; E. Sanger-Shepherd; Sir J. W. Swan, D.Sc., M.A., F.R.S.; Major-General Waterhouse, I.A.; E. J. Wall.

Only one medal was awarded, viz., to C. Welborne Piper, for "models of light pencils showing various effects of aberration."

Oct. 11 to Nov. 10.—Single picture exhibition by members of the Professional Photographers' Association, at the "British Journal" Offices.

Oct. 16.—Meeting to form a "Society of Colour Photographers," held at the "British Journal" Offices.

Oct. 23, 1906.—Ninth Memorial Traill-Taylor lecture, by E. Walter Maunder, F.R.G.S., on "Photography in the Work of Greenwich Observatory."

COPYRIGHT.

Proposed Alterations in Copyright Law.—"A Bill to amend the Law of Copyright" is drafted by the Artistic Copyright Society. The full text of the Bill (reported in the "B.J." for January 19, 1906) appears to abound in ambiguities and contradictions. The Bill prescribes the marking of all copyright photographs as "Copyright," omission to comply with this clause apparently depriving the photographer of his copyright. The Bill also distinguishes between photographs and other forms of "fine art" as regards the copyright privileges it grants. A criticism of its clauses leads to the conclusion that there is no immediate prospect of its becoming law.—"B.J.," Jan. 19, p. 44, and Feb. 2, p. 83, 1906.

Valuable Consideration.—The case of Stackemann v. Paton puts a new construction on the term "good or valuable consideration," Mr. Justice Farwell holding that certain concessions to the

photographer may be "good consideration." The plaintiff, Mr. Stackemann, trading as the Photographic Tourists' Association, was in the habit of making photographs of boys' and girls' schools in various parts of the country. His method was to cause his traveller to pay a visit to the school, requesting permission to take a series of photographs solely at the firm's risk, and submit proofs. On permission being given, the photographer attended and obtained a series of interior and exterior views, from the negatives of which proofs were submitted and copies supplied to the order of the proprietor of the school. The Photographic Tourists' Association also printed and supplied prospectuses containing reproductions of the photographs, and they relied for one source of their profits on the sale of such prospectuses. The two photographs which led to the action were each taken in this way. They subsequently appeared in advertisements of the respective schools published in "Paton's List of Schools, 1905," the proprietors of the schools having sent to the publishers photographs taken by the plaintiff, from which they (the publishers), had made half-tone blocks which were printed in the list. The point at issue in the case was whether the plaintiff had, or had not, received a good or valuable consideration for taking the photographs. No monetary consideration was made to the photographer for the taking of the photographs in the first instance, and therefore, according to all precedents in the courts, the copyrights in the photographs were the photographer's. In the opinion of the judge, however, the act of admitting the photographer to the school and permitting him to take photographs on the chance of selling them to the proprietors was a good consideration. He held that the fact of the photographs being made without any obligation to purchase did not affect this view of the case. Such a provision might be introduced into any contract, and he was not able to believe that it was the intention of the parties that the plaintiff should be allowed to sell copies of these photographs to the public. Mr. Justice Farwell thought that the case was not on all fours with that of Ellis and Marshall (1895, see article "Photographic Copyright," "B.J.A.," 1906), where it was held that the sitting given by Miss Mary Moore to Mr. Ellis was *not* a valuable consideration, and where it was the intention of both parties that the photographer should have the copyright. It was held that the concession to Mr. Stackemann was a "good" consideration, and a judgment was given for the defendant.—"B.J.," May 4, 1906, p. 343.

The Crooke-Irving Case.—The First Division of the Court of Session, on June 22, 1906, reversed the decision of Lord Ardwall in the action brought by Mr. W. Crooke against the Scots Pictorial Publishing Co. The previous judgment (B.J.A., 1906, p. 722) had implied that the person arranging a sitting for another person with a photographer was *prima facie* entitled to all the portraits taken at the sitting unless it could be shown that other arrangements were made. The revised judgment maintains the position that a number of photographs may be taken of a person at one sitting arranged by a third person, and copyrights in certain of them are

obtainable by parties other than the party arranging the sitting, provided that the photographer be paid in respect to these photographs.—"B.J.," June 29, 1906, pp. 502 and 510.

Copyright in Sculpture.—Attention is called to the slight protection enjoyed by sculpture under copyright law, it being an infringement to reproduce it only as a cast or mould, but not as a drawing or photograph.—"B.J.," Aug. 24, 1906, p. 678.

Copyrights in Cinematograph Films.—The "B.J." points out that the Artistic Copyright Act (1862) gives no remedy for cases of piracy where the incidents of a film are reproduced with slight variations by another maker. There has been no copy, and therefore no infringement. Yet it is possible that the same measure of protection for a film is obtainable as for a play in dumb-show, to which the exhibition of a cinematograph film of the "story" order very closely approximates. Protection of this kind would presumably be no preventative of production or sale; but if it could be enforced it would restrain exhibition which is good enough for any film maker.—"B.J.," Dec. 22, 1905, p. 1002.

BUSINESS.

Assistants' Wages.—John A. Randall has compiled the following table:—

WAGES IN 1905.—PER WEEK IN SHILLINGS.

	Rates by Assistants.			Rates by Employers.		
	1	2	3	1	2	3
Artist	65	60	55	100	70	60
Operator (Studio)	84	40	25	80	35	25
,, (Press)	60	—	—	60	30	20
,, (Commercial)	140	100	80	—	—	—
Operator and Retoucher	63	35	25	70	35	25
Retoucher	42	30	20	40	25	20
,, and B. & W.	50	30	25	30	25	—
Assistant Operator	50	30	20	30	25	21
General Assistant	45	25	20	40	25	18
Enlarger	42	—	25	—	—	—
Printer	35	25	21	30	25	20
,, (Bromide)	35	30	25	30	25	21
,, (Carbon)	35	—	—	63	42	—
Receptionist	30	25	16	—	—	—
Mounter and Spotter	18	14	10	15	—	—
Improver	21	15	10	18	15	10
Apprentice (Premium)	—	—	—	£75	£50	£40
Manager (Working)	50	40	25	35	30	25

The figures are averages of a number collected from the advertisement columns of THE BRITISH JOURNAL OF PHOTOGRAPHY and from other sources. In comparison with a similar table for 1897 it is seen that operators, artists, and workers of special ability are much better paid than in 1897.—"B.J.," April 6, 1906, p. 269.

"The Cost of Manufacturing in the Photographic Studio," by F. Dundas Todd, in the "Photo-Beacon." A lengthy paper, showing how costs should be apportioned in the photographer's business.—"B.J.," Sept. 21, 1906, p. 748.

Photographers' Stationery.—W. J. Casey discusses a number of points which should be considered by photographers in the production of their notepaper, bill headings, etc.—"B.J.," Jan. 5, p. 5, and Jan. 12, p. 25, 1906.

Postcard Production.—F. T. Corkett, of Raphael Tuck, gives some statistics of the picture postcard:—In 1899 it was difficult to get a stationer in a South Coast resort to take into stock 1,000 cards. Last summer the same stationer confessed to having disposed of 100,000 cards in the course of a year.

In the Postal Union returns for 1903, the entry against Great Britain is for no less than 613 million postcards, three-quarters of which it is estimated, or 450 million, were of the picture variety. A census of the postcards passing through this office was taken last year by the Blackpool postmaster during the holiday season (July and August, 1905), from which it was found that an average of 215,000 picture postcards *per week* were despatched from Blackpool during the period, while in one week (the first week in August), as many as 300,000 picture postcards were posted.

It is estimated that two-thirds of the postcards published in Great Britain are views and of photographic origin. Just at present there is also a wave of popularity for the bromide card of actresses' portraits, and the output of one firm which specialises in this line has been estimated at 1,000,000 per week, equivalent to 20,000 yards of sensitive material 34 inches wide.

During 1904 over 2,500 million postcards went through the post in Germany, Great Britain and America alone. The figures for 1905 are not yet available, but it is anticipated that the total for these three countries will reach nearly 5,000 million.—"B.J.," Feb. 9, 1906, p. 108.

HISTORY.

Self-toning Paper.—D. Bachrach, writing to the "B.J.," claims to have first published a method of making self-toning paper, viz., in "Wilson's Photographic Mosaics," 1888.—"B.J.," April 20, 1906, p. 319.

This claim is confirmed in some historical notes on the subject, in which the work of Hennah, Marten, and Barnes is discussed in reference to that of Bachrach.—"B.J.," April 27, 1906, p 324.

"The History of Gelatine Emulsion," by J. Burgess; a paper before the London and Provincial Photographic Association.—"B.J.," Nov. 10, 1905, p. 886.

SOCIETIES.

The Summer Programme.—Suggestions for the vitalizing of the summer activities of a society include field demonstrations of the use of the camera. Two popular fixtures for the summer programme would be to arrange a couple of outings at which one or more of the acknowledged successful "pictorial" members demonstrated the production of a picture—landscape, seascape, figure, still-life, or architecture—from selection of the point of view to the making of a finished print.—"P.N.," Jan. 26, 1906, p. 63.

II—APPARATUS AND EQUIPMENT.

(Including raw materials used in photography).

The many details of pieces of apparatus published chiefly in patent specifications are not abstracted in this "Epitome," space not permitting of the reproduction of the numerous drawings which would be needed to accompany such abstracts. Patent specifications dealing with apparatus are abstracted in "The British Journal of Photography" and are entered according to subject and also under the name of the patentee in the index to the volume issued with the first issue in January of the following year.

Dark Room and Studio.

Liquid Dark-Room Safe-Lights for Orthochromatic Work.—A new type of dark-room lamp has been devised by Dr. E. Stenger and placed on the market in Germany. The ordinary incandescent electric lamp is surrounded by a cell containing a dye solution, with which the receptacle can be charged, and of which it can be discharged as may be necessary. Moreover, the lamp can be at once removed for renewal or repairs. The lamp attains its full temperature six hours after lighting, and in the course of twelve hours' use was found to have lost only 24 grammes of water by evaporation. The liquid filters, of which the formulæ are given below, are found greatly superior to ruby glasses in point of brightness for the same, or a much higher, degree of safety.

Tartrazin .05 per cent. solution absorbs to λ 510.

Potass. bichromate 10 per cent. solution absorbs to λ 550.

Potass. bichromate 10 per cent. solution, with fuchsine 1 gm. per litre, absorbs to λ 620.

Potass. bichromate 10 per cent. solution, with fuchsine 2 gm. per litre, absorbs to λ 630.

Potass. bichromate 10 per cent. solution, with fuchsine 5 gm. per litre, absorbs to λ 635.

Potass bichromate 10 per cent. solution, with acid violet 2 gm. per litre, absorbs to λ 650.

Tartrazin .05 per cent. solution, with acid violet .2 gm. per litre, absorbs to λ 645.

Tartrazin .05 per cent. solution, with methyl violet .2 gm. per litre, absorbs to λ660.

—"Zeit. Wiss. Phot.," Aug., 1905, p. 233; "B.J.," Sept. 12, 1905, p. 732.

Dark Room Illumination for Working Red-Sensitive Collodion Emulsion.—Fritz Haberkorn, dealing with the dark room illumination when using red sensitive collodion, though the remarks are obviously also applicable to gelatine plates, points out the danger of using a red illumination, and gives the following formula for the preparation of a deep green screen:—

Gelatine	12 gms.
Distilled water	200 ccs.

Allow to soak for an hour, and then melt by the aid of a water bath and add :—

Bluish acid green (Hoechst)	3 gms.

Then add :—

Tartrazine solution 3 per cent.	1.2 ccs.
Naphthol green solution 4 per cent.	2 ccs.

Stir well and filter, whilst hot, through felt. Plate glass should be thoroughly cleaned, then rubbed with a 0.5 per cent. of potash water-glass and accurately levelled. To every 100 sq. cm. of glass allow 7 ccs. of the dyed gelatine. Two such screens are required, and one should be coated with matt varnish. If possible, also, a sheet of ground glass should be placed in the lantern between the light and this screen, as it cuts off a good deal of the heat; then the matt varnish can be omitted.

For tank lamps a solution of the following composition may be used :—

Distilled water	800 ccs.
Bluish acid green 2 per cent. solution	25 ccs.
Naphthol green 4 per cent.	1.5 ccs.
Tartrazine 3 per cent.	1.2 ccs.

This is for an internal width of 2½ cm.

In order to test the efficiency of these screens, a plate coated with Albert's rapid red emulsion was exposed behind a Chapman-Jones sensitometer at a distance of 30 cm. for five minutes, and then developed. The different screens used were :—1. A combination of a copper ruby glass, a dark yellow, and a bright yellow ground glass. 2. König's methyl violet and tartrazine screen. 3. Two glasses coated with Albert's green collodion, one with matt varnish. 4. Two of the above described glasses, one with matt varnish. (The size of all the screens was 33 cm. square, and the light a 16 cp. incandescent electric lamp.) 5. Stenger's lamp filled with the fluid above given. The results were as follows :—

Combination.	Spectrum Transmitted in λ	Last Number Visible.	Relative Quantity of Light.	Appearance of Plate.
	610–710	—	—	Totally fogged, no numbers legible.
1	670–760	—	—	
2	485–575	15	24	Clean.
3	490–530	10	128	
5	490–525	9	192	

This proves that 1 and 2 are quite useless, and that 4 and 5, whilst more brilliant, are from four to eight times safer than Albert's green collodion. The region λ 490—530 practically excludes F. and E, and comprises the little *b* group.—"Phot. Korr.," July, 1906, p. 344.

STUDIO.

Reflected Arc Light in Studio.—Herr Rösl describes the following studio for electric light work:—A stout wood framework, as shown in Fig. 1, should be constructed, and a semi-circular roof erected on the openwork sides, so that a kind of cage in the form of a tunnel

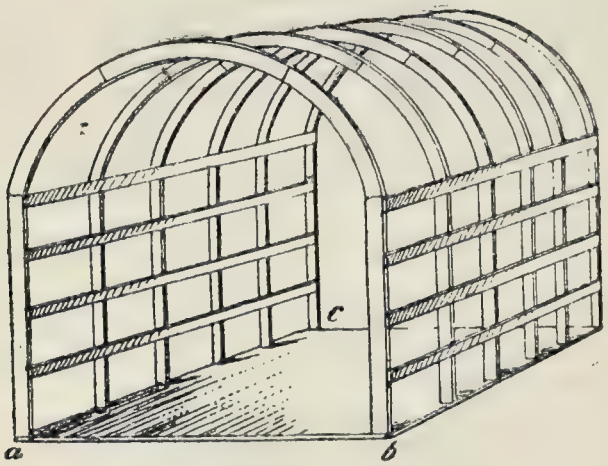


Fig. 1.

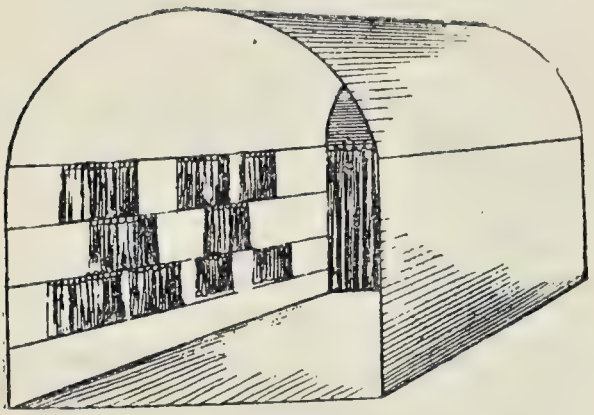


Fig. 2.

is formed. The measurements are approximately: Breadth *a-b*, 13ft.; length *a-c*, 19½ft.; height to the top of the arch, 14½ft. The studio in which the above arrangement was erected had sufficient length to give ample working distance.

The frame is covered inside with white linen, so that it finally presents the appearance shown in Fig. 2. Right at the end will be seen a heavy plush curtain, which is useful for head and shoulder pictures; when this is drawn on one side the background is exposed.

The lamp used in this studio consists of two arcs, burning side by side, which are supported on a movable pillar and are enclosed in a reflector, by means of which the light is directed in any desired direction, the front being also provided with a matt diffuser.

The light is never used direct, but always directed against one of the sides of the tunnel and thence reflected on to the sitter. In

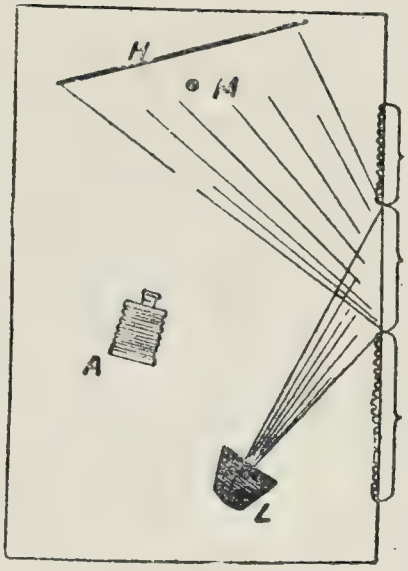


Fig. 3.

order to control the lighting the sides of the structure are provided with dark grey linen curtains, each about 180 inches square, with which the whole of the sides can be covered up or only a part, so as to leave a reflecting surface.

As in an ordinary studio the light is controlled by drawing the curtains, and the top light is treated in the same way.

The author states that the results obtained by this method of working cannot be distinguished from ordinary daylight work. Every possible effect is easily obtained, and he considers that this is a great advance in studio construction, and that extremely short exposures are required with a lens working at *f*/4.5.—"Phot. Woch.," March 6, 1906, p. 90; "B.J.," March 30, 1906, p. 247.

Backgrounds.—John Everard describes (1) the different materials obtainable as background mediums; (2) the method of preparing the distemper; (3) the selection of design; and (4) the actual process of painting the ground.

(1) Cloth is the best and most serviceable, but is the most expensive. Calico, bleached or unbleached, comes next, but, compared with cloth, the difference in price is very appreciable. Next comes felt brown paper. The approximate cost of these materials is as follows:—Cloth, from 4s. to 5s. per yard, width 96 in.; calico, bleached, 10½d. per yard, width 72 in.; calico, unbleached, 10½d. per

yard, width 72 in.; felt brown paper, the price varies from 4d. to 8d. per yard; in width, the paper is generally obtainable from 40 to 60 in. To mount the material on a stretcher, lay the latter on the floor and cover it with the *damped* material. Now cut up a sheet of cardboard into small pieces, each piece being about ½ in. square. You will also require a few dozen brads and a small hammer. With these implements, etc., close at hand, proceed as follows: Get a friend to hold the lower right-hand corner of the material down to the corresponding corner of the stretcher; take hold of the top left-hand corner yourself, and, gently pulling the material until quite taut, tack it to the edge (not to the face) of the stretcher. The tack should be driven through a piece of cardboard, thus preventing the material tearing away from the stretcher. One tack on each side of the corner will do at first. Repeat the operation at the corner held by your friend, and at the lower left-hand corner; then at the top right-hand corner. Next place one tack in the centre of the top edge, and one at the bottom, one each at the left and right-hand sides, finally tacking the edges down all round where necessary. The next procedure is to size the material Measure out six ounces of pure starch, and boil it in 18 ounces of water. When dissolved, apply this solution with a stiff brush, then stand the stretcher on end. The screen, when dry, is ready for painting.

(2) Painting. Besides three or four stiff hog-hair brushes of medium thickness, you will require three earthenware pots or flower-pot saucers, 6 oz. whitening, 2 oz. powdered glue, and 3 oz. treacle. Purchase also the following water-colour pigments from the local house-painter's establishment: ½ oz. ivory black, ¼ oz. ultramarine, and ¼ oz. red ochre. Grind the pigments—dry—in a mortar, or by any other means so long as they are ground to a fine powder. Dissolve the whitening, glue, and treacle in 40 ounces of boiling water; divide the mixture into three equal portions, and pour each portion into an earthenware pot. Now mix the three colours (still in their dry state) together, and divide the powder into six equal parts. In pot No. 1 place one part; in pot No. 2 two parts; and in pot No. 3 the remainder of the powder. Thus you will have distemper of three tones, light, medium, and dark. Having tacked the material to the wooden stretcher, and prepared the distemper, the next operation should be to paint the background—a suitable design having been obtained.

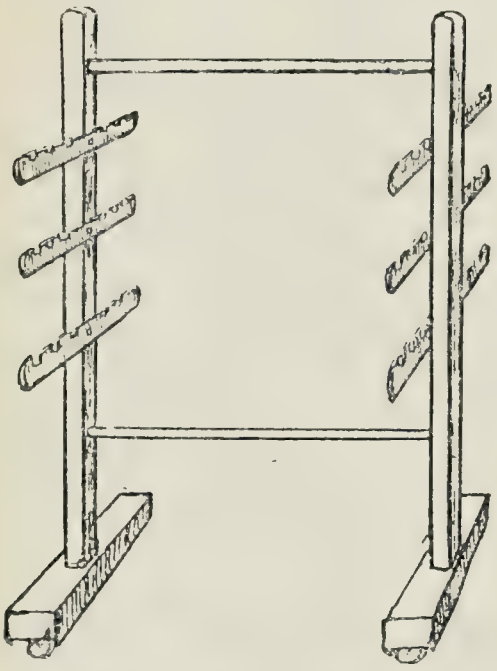
(3) Graduated and cloud backgrounds are the easiest to paint; "landscape" scenes are a little more difficult; but "interior" designs are almost impossible to all but the expert scenic artist. The home worker should be able to make or use existing landscape negatives for background purposes.

(4) In the painting operations, the essentials are: 1, to get the design outlined correctly on the screen; 2, to finish the background when once the operations have been begun. Having made a transparency from the negative, slip it into a projecting lantern, and project the image on to the back of the stretched material. Then, taking up a position in front of the screen you will, with a stick of charcoal, be able to sketch in the outline within the space of a few minutes. Should the screen consist of opaque material, the image

must, of course, be projected on to the front. But in either case the sketching process is very easily performed. Now for the distemper. Place the three earthenware pots within easy reach, and a brush in each. Commence at the top of the screen and work downwards. First paint in the light tones, then the medium, and finally the dark ones. Be careful not to make the outlines too pronounced; eschew the desire to define the leaves, branches, etc., sharply; and, above all, remember that when wet, the tones will be very similar. The latter is a most vital point. Do not give way to the temptation to make the tones well differentiated, otherwise, when dry, the background will be hard and patchy. If any very light tones are required, these may be lightly brushed on after the ground is finished. It is advisable to make a trial on a small piece of material. —"A.P.," March 13, 1906, p. 208.

Hanging Backgrounds.— W. Foster Brigham, after some notes on practical considerations governing background-hanging, describes a new stand, of his own design, for grounds on stretchers; eight or more grounds only taking up the space of one stretcher on feet.

All the frames must be of an exact size. The side-pieces are then divided exactly into two halves. At this point a hole is to be bored,





and a round pin let in exactly at right angles to the side of stretcher, and projecting about 2 in.

A stand is now to be made with two uprights, which may be of any height, joined with two crossbars of such a width that the two uprights are kept slightly more apart than the width of the stretchers.

These two uprights should be supplied with feet and castors, but as the whole complement of background will be heavy, a large base is advisable.

On the uprights, on the inner side, facing one another, and at an equal height to their fellows, place transversely two, three, or any number of pairs of arms, noting only that the lowest arm is of such a height that when the background frame is hung between on the pins the bottom shall just miss the ground. The others may be at any varying distance required—three are enough, giving three different heights for ground.

It will be seen also that either end of background can be used with equal facility, and there can be a ground on each side of frame.

The supporting arms may be of any convenient length, but must be shorter than the feet. There should be two, four, or six U-shaped slots in these arms to take the pegs in background frame, an equal number on each side of the stand, and as close as the width of the frames will allow.

By far the best roller method is the theatrical system, the curtain rolling from the bottom.

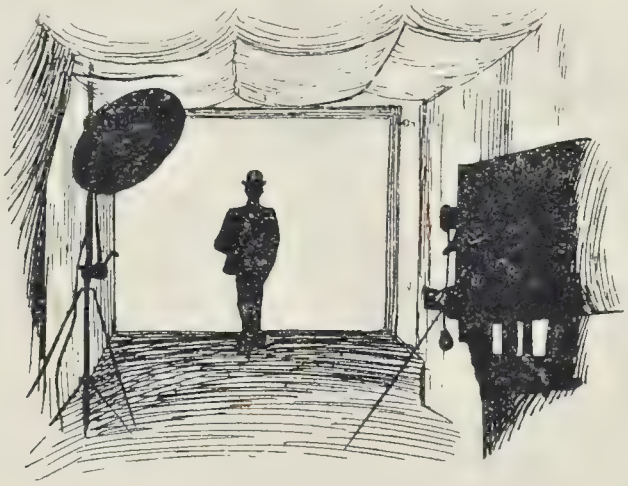
Here the top of ground is tacked on to a flat, stiff board, taking care to get the line of tacks at right angles to the sides of ground. The bottom is fixed to a roller, a foot longer at each end than the background, and taking the same care to get it at right angles to the side and parallel to the top board. The roller should be about 2 in. in diameter. The only difficulty is to explain the cording of this system; it is perfectly easy when you are fitting it up, but intricate to explain. Take two separate pieces of thick picture cord, one twice the length, and the other three times the length of background. Obtain a single block pulley wheel and a double block wheel (i.e., two separate and distinct wheels in one fitting), and screw on to the top board of ground, an inch or two further apart than the width of ground. Now, for ease in fitting, put board in place with ground hanging down. Now take the longest piece of cord and fasten the end with a tack on to the free end of roller, which is just below the single wheel and on the opposite side to the cleats upon which the cords are to be fixed when the grounds are rolled away. Now make about a dozen turns on the roller, away from you (it is always an easy matter to give more if that is not enough to roll ground properly), and now pass the end of cord through the single pulley, take along the board, pass through the double block, and down to cleat. Now do the same with the other cord, but pass through the free wheel of double block only, and down to cleat. It is now best to join the two cords.

If all this has been done properly, when the double cord is pulled it will be found that the bottom roll turns round and winds up the background as far as the board.

The only objection to this method is the quantity of cord left over when the grounds are rolled up. But if large cleats are fixed at side of grounds, this can easily be kept out of the way, preserving the qualities of compactness and easiness of access that makes the blind system the only possible one in some studios. One of the disadvantages of this system, however, has been the fact that a foreground

could not be used in one piece with background. We have got over this difficulty, however, in the following way: A large roller was obtained with two instead of only one groove—half an inch separating them. It is almost impossible, by the way, to use this method without using this type of roller, tacking being so liable to screw. The background and foreground combined was fixed to the board, with the wheels attached, as before explained, and allowed to hang loose. The roller, with tongues removed, was now laid *on* the background with the ends a quarter of an inch above the floor. The tongue was placed *behind* ground, and forced into the top groove, leaving the unoccupied groove open and in front of ground. The extension piece now comes from behind the roller. Now place the second tongue *underneath* the extension and force in groove, tightening the material round the roller. If the roller is now wound with cord, as in the ordinary way, the extension piece and background will roll up together. It is necessary, however, to keep the extension piece free from creases, as the marks will be communicated to background.—"B.J.," Dec. 15, 1905, p. 989.

Natural Backgrounds in Studio Portraits.—A process of producing a negative in which a natural background is obtained behind a sitter photographed in the studio has been patented by Dischner. The background, which is to appear in the photographs, exists only as a positive transparency on glass, which is held in a frame within the camera, being pressed film to film into contact with the plate in the dark slide when the shutter of the latter is withdrawn. The attachments to this carrier frame permit of it being turned down on to the bottom of the camera, the adjustment being made by a



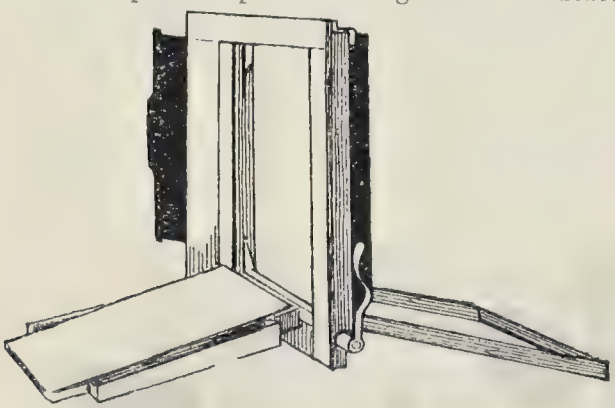
Arrangement of the Lighting for the first Exposure of the Sitter.

lever outside the camera. The sitter is posed in the ordinary way, his position on the focussing screen being viewed with the transparency in position, upside down, of course, in order that he may be

disposed in harmony with the background. He is then illuminated from behind through a white screen, and a very brief exposure given with the background in contact with the plate. The result is an impression of the background, except where the image of the sitter falls; here the plate remains unexposed. A dead black ground is then let down, the studio (artificial) light switched on to illuminate the sitter in the usual way, and a second exposure made without the sitter having moved from the position first assumed, and with the background transparency thrown back.—Eng. Pat., No. 27,088, 1905 ("B.J.," May 4, 1906, p. 346, where examples of the process are reproduced).

The method is an adaptation to dry plates of that described by Tilley in "The Photographic News," Sept. 24, 1875.

Dischner's patent claims (No. 27,088, 1905) are: (1) A process for the production of composite photographs, in which a picture background in the form of a positive transparency is placed in contact with the sensitive *dry* plate. (2) The process as described in the preceding claim, but in which the model or subject is illuminated by a flash or artificial light. (3) For carrying out this process according to the preceding claims, a plate carrier, consisting of a hinged frame adapted to hold the positive picture background in contact with the



During the Second Exposure the Background Transparency is thrown forward as shown here.

sensitive plate during one exposure, and to let it fall or move out of the path of the light rays falling upon the sensitive plate during the other exposure.—"B.J.," June 15, 1906, p. 472.

Studio Blinds.—Blochmann explains the choice of blue and white blinds for the studio on the ground that they are the easiest to obtain, are the cheapest, and that the diffused light they give tends to softness of results. When these colours were chosen, wet plates were the only sensitive material, and when dry plates were first introduced they were only sensitive to blue and violet. Of late years, especially for costume studies, orthochromatic plates have become more and more general. Professionals lay greater value on these plates, not only because the colours of dresses are better rendered, but because in other cases, as in light hair, dark blue

dresses and yellow embroidery, a rendering more nearly like that seen by our eyes is obtained.

The dark blue blinds in the studio have, to a certain extent, the same effect as monochromatic blue illumination. If they do not absorb all the yellow rays of white light, they still absorb a greater portion, and give a blueish illumination to the object, which does not give the best results on an orthochromatic plate. If, on the other hand, yellow or orange-coloured curtains were used, the full effect of the ortho plate would be felt, or, at any rate, a lighter yellow screen be required.—"Atelier," Feb., 1906, p. 18; "B.J.," Feb. 23, 1906, p. 149.

Lenses and Photographic Optics.

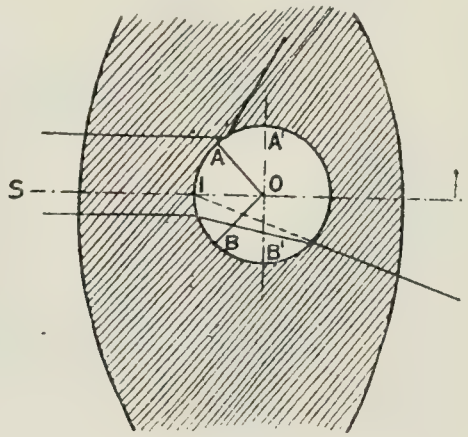
GENERAL OPTICS.

Optical Nomenclature.—A number of terms are suggested for the avoidance of confusion in writings on photographic optics, e.g., the terms "nodal," "pupilar," "extra-focal," and "polar," as applied to distances of some part of, or point in, a lens from its focus.—"B.J.," July 13, 1906, p. 543.

Perspective of an Aerial Image formed by a Lens.—A graphical method of tracing the form of the aerial (three-dimensional) image given by a photographic lens appears in "B.J.," July 27, 1906, p. 583.

OPTICAL GLASS.

Air Bubbles in Modern Lenses.—M. Delamarre, dealing with this subject, utilises the following figure and explanation:—Let O be the centre of an air bubble, and S I the direction of the luminous pencil. From the point O draw the two lines O A and O A^1, making, with



S I, an angle equal to the angle of total reflection, which is about 40deg. to 41deg. for most glasses All rays of light striking the bubble between A B and A^1 B^1 cannot penetrate it, but are totally reflected, and the only rays which can pass are included between A A^1. These will be refracted away from the path S I, and cannot

form any part of the image; therefore all air bubbles act as opaque bodies. The loss of light by this, however, is very small, and as has been proved by Schott and Gen. only amounts in the worst cases to 0.02 per cent. of the light entering the lens.—"Phot. Gaz.," Feb., 1906, p. 64.

Increasing Brilliancy of Images.—H. Dennis Taylor patents:—(1) The use of intentional artificial means of tarnishing polished glass lenses as nearly as possible to the darkest brownish slate colour, either by immersion in suitable chemical solution, or in gaseous reagent, or by intimate contact with more solid substances of suitable nature, whereby the light-transmitting power of such lenses is enhanced, and their light-scattering power correspondingly reduced, thus leading to the greater brilliancy of the final images formed by such lenses; and (2) the use, for tarnishing freshly polished lenses of densest *baryta* crown glasses, or the densest *baryta* flint glass of the dilute solution of ammonium hydrosulphide and nitric acid. The patent specification details at length the manner in which the invention is to be carried out. English Patent, No. 29,561, 1905.—"B.J.," Dec. 22, 1905, p. 1012.

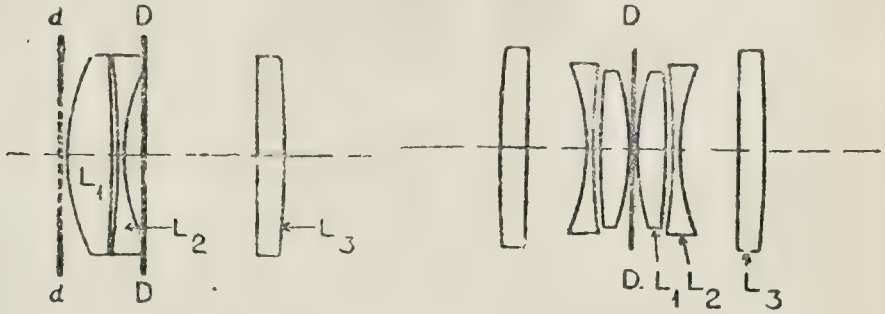
Absorption of Ultra Violet Light by Lenses, Etc.—A. J. Newton and A. J. Bull have tested the absorption by various lenses, prisms, cross-line screen, etc., of ultra violet light by photographing the spectrum of the iron arc interposing the various media in the path of the rays. The qualitative results show a complete absorption of the ultra-violet up to 3,170 A.U. by all the lenses tested, the "Actinolux" lens, of Watson and Sons, specially made for process work, passing this part of the spectrum.—"Phot. Journ.," July, 1906, p. 282.

Uviol Glass.—K. Martin points out that the aperture already attained in portrait aplanats in which the ordinary glasses are used is *f*/3. To make such a lens it is necessary to have two glasses, of which the v difference—that is, the difference of the reciprocals of the relative dispersions—must amount to about eighteen. The difference, however, between the uviol glass and flint of Schott and Co. is only nine, and it is not possible to construct an aplanat with an aperture of *f*/3 with these glasses. An uncemented lens could possibly be made, but the loss of light by reflection from the numerous surfaces would do away with the advantage of the increased amount of ultra-violet light passed by the lens. Independently of this it is an open question whether for ordinary photography a greater transmission of ultra violet light would be an advantage, particularly, as pointed out by Martin, that the use of colour sensitive plates and yellow screens is becoming more general. For astronomical work and photomicrography, where colour-rendering is of less moment, lenses made of this glass might be useful.—"Phot. Woch.," Feb. 27, 1906, p. 82.

PROPERTIES OF LENSES.

Cooke Lenses.—H. Dennis Taylor has patented modifications which permit of separate parts of the Cooke lens being used as lenses of twice or thrice the focal length of the complete lens. The claims are:—1. A triple or quadruple Cooke lens, having the power

of its negative lens, or the sum of the powers of its two negative lenses, approximately equal to the sum of the powers of the two (modified) positive lenses, so that it can be used either singly or conjointly with a similarly modified lens of equal or unequal focal length. 2. The conjoint use of Cooke lenses already existing, such as the one described herein as Series V : any two of such being joined together as in Fig. 2, with a stop between them, and their focal lengths being equal or unequal. Fig. 1 shows a section of the series V Cooke lens, which, as it stands, is more suited than any other of them for conjoint use, although it requires modification. At present



the diaphragm is situated close behind the negative lens at D—D, but for conjoint use the diaphragm has to be transferred to the front of the front lens L^1 as shown at *d*—*d*. But that position is so much further from the back lens L^1 that pencils of light of a moderate degree of obliquity cannot get through the combination, but strike outside of the aperture of the back lens. Therefore, the modification that is, as a rule, required is to get the whole combination shortened up along the optic axis so as to get the aperture of the back lens to subtend a larger angle as viewed from the centre of the front stop. That being attained, then two such front stop lenses of equal or unequal focal lengths, may be placed together as in Fig. 2, stop to stop : one stop then acting in common. Thus the whole combination will yield a very powerful lens of large aperture, while either half, used preferably with the stop end towards distant objects, will perform as a self-contained and perfect lens of a longer focal length. In order to obtain the largest positive relative aperture L must be about equal power to L^1, but in order to get the spherical aberration balanced in such a case it is absolutely necessary to divide the negative lens into two parts or lenses of equal or unequal power. Fig. 3 is a sketch of such a combination as roughly calculated out, whereby it is hoped finally to get an aperture of *f*/7 and of *f*/3.5 when two such constructions of equal focal length are used conjointly. In all the combinations suggested above it is necessary, in order to obtain a flat final image substantially free from astigmatism, to embody the principle which formed the basis of the Cooke lenses (Patent No. 22,607, 1893), viz., that the sum of the powers of the negative lenses employed must be

approximately equal to the sum of the powers of the positive lenses, a large part of the power of the combinations being the sole result

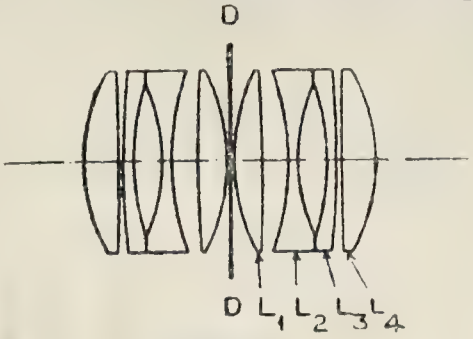


Fig. 3.

of the separations between the component lenses. Eng. Pat., No. 3,398, 1905.—"B.J.," Feb. 23, 1906, p. 152.

New Cooke Lenses.—H. Dennis Taylor patents a quadruple lens consisting of two exterior simple bi-convex positive lenses enclosing between them two simple bi-concave negative lenses; the refractive indices being so arranged that while the glass of one negative lens has a substantially lower refractive index than the glass used for the positive lens adjacent to it, the glass of the other negative lens has a substantially higher refractive index than the glass used for the positive lens adjacent to it, while the sum of the powers of the two negative lenses is about 93 per cent. of the sum of the powers of the two positive lenses, a condition necessary to the attainment of a flat image substantially free from astigmatism.

In the combination made on these lines:—

1. The Petzval condition is to be approximately fulfilled.
2. The positive lens to have the highest refractive index in one-half of the lens, and the negative lens to have the highest refractive index in the other half of the lens.
3. All lenses to be double convex or double concave.
4. It is desirable, but not essential, that three lenses at the very least shall have high refractive indices.—Eng. Pat. No. 24,391, "B.J.," Oct. 12, 1906, p. 812.

LENSES IN PRACTICE.

Artistic Lenses.—Major Puyo and L. de Pulligny contribute notes on the properties and use of the single and double lenses uncorrected or partially corrected for chromatism, and known as "anachromats." They point out that these long-focus lenses, working also at apertures of $f/5$ to $f/8$ are very suitable for portraiture and all photographic work in which pleasing perspective is desirable.

A corrected lens will give a negative image of an object, consisting of sharply defined regions, as in Fig. 2, which is supposed to represent a part of the negative greatly enlarged. If the lens, however, is anachromatic, the straight edge of the band A A^1 will be blurred. This blurred fringe will encroach on the white portion B^1 B, and will cover it if the breadth of this white band is about the same size as that of the blurred fringe. The fringe on the left

hand of the band C C^1 will act in the same way in toning down B B^1, and if the exposure be prolonged, B B^1 will be more or less tinted.

On the other hand, the quantity of light received on α β and γ δ being the same, the bands A A^1 and C C^1, if equally exposed, will print less strongly.

Thus it will be seen that the square α β γ δ, instead of consisting of black and white bands, will tend to become a grey patch of tone midway between that and the white and black (Fig. 3).

At their full apertures the lenses give a certain amount of diffusion, which can be regulated:

(1) By Decreasing the Size of the Stop.—The breadth of the blurred fringe is equal to 1-100th of the diameter of the stop. By decreasing the latter, we diminish the blur.

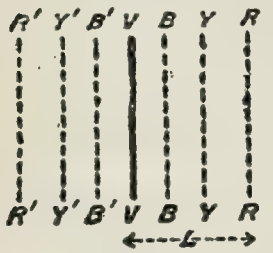


Fig. 1.



Fig. 2.

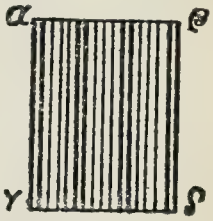


Fig. 3.

(2) By Altering the Exposure.—From Fig. 1 we see that the blurred outline is supplied by the less active rays, and, therefore, if we cut down the exposure, the red rays will not have time to exert their action, and the image, instead of spreading to R R, R^1 R^1, will spread only to Y Y, Y^1 Y^1. If the yellow rays are allowed sufficient time for their action, the chromatic blur will be still more restricted, viz., to B B, B^1 B^1. Thus the degree of synthesis will be proportionate to the length of exposure.

(3) By the Partial Correction of the Anachromatic Lens.—For this reason one of the special lenses has been called the "semi-anachromatic," the chromatic aberration in it being reduced about half to one-third the breadth of the blurred region, diminishing in equal proportion.

The advantages of the anachromatic lenses may be summed up as follows: Drawing without hardness; blurring of details, and therefore suppresion of retouching; unison of the figure with the background; breadth of drawing proportional to the scale of the image.

Focussing with the anachromats should be done carefully as with all lenses, if the maximum sharpness is desired in one part of the image rather than in another. The best plan is to focus on printed characters (the title of a journal) held by the sitter and with a medium stop. A larger or smaller stop is then inserted, as may be desired, before exposing the plate. A small correction must be made in the focus before exposure, but the correction does not need to be very exactly made, nor need it involve calculation of any sort.

MM. Puyo and de Pulligny have embodied the calculations from which the lenses are made in a small book ("Les Objectifs d'Artiste. Theory and Practice of Anachromatic Lenses." One volume, 232 pages, 49 figures in the text and 6 plate illustrations. London: Dawbarn and Ward, Limited. Price 5s.), to which reference may be made, in addition to the following papers on the subject:—

"La Photographie synthetique." By Major Puyo. "Revue de Photographie," April 15, May 15, and June 15, 1904.

"Bulletin de la Société de Photographie," October 1, 1904, Compte rendu of the Section Nancy. Telephoto and anachromatic lenses by E. Wallon, p. 455.

"Le Flou chromatique." By M. de Pulligny. "Bulletin du Photo-Club," March, 1902; "B.J.," March 9, 1906, p. 184.

Some further notes, on a particular specimen of the Puyo-Pulligny lens, appear in the "B.J.," April 13, 1906, p. 283.

Depth of Focus.—Gaston M. Alves gives the following rules, based on a disc of confusion of 1-100th of an inch:

Multiply 100 by the square of the focus of the lens, and divide the product by the denominator of the stop used. The quotient will be the least distance, in inches, beyond which all objects will be in depth of focus."

Square the focus in inches, and we have the distance in feet, beyond which all is in depth of focus, with aperture, *f*/8 (U.S. No. 4).

He gives the following table of front and back focal depths:—

Table of the Back and Front Focal Depths in inches, for the Stops and Distances given. Focus of Lens, 8 inches.

Stops.		Distances in Feet.						
		6	9	12	15	18	24	30
F 4	Back	3·2	7·2	13	22	32	61	103
	Front	2·7	6 4	11	17	25	43	64
F 5·6	Back	4·8	11	20	33	48	93	155
	Front	4	9·2	17	26	38	65	96
F 8	Back	6 4	14	26	44	64	122	206
	Front	5·4	13	22	34	50	86	128
F 11	Back	10	22	40	66	96	184	310
	Front	8	18	34	52	76	130	192
F 16	Back	13	28	52	88	128	264	412
	Front	11	26	44	68	100	172	266

For lenses other than 8 in. focus, take out the proper quantity above, and multiply it by the proper factor below:—

For 5-in. focus, multiply by the factor	2·56	For 14-in. focus, multiply by the factor	·37
,, 6 ,, ,, ,, ,,	1·78	,, 15 ,, ,, ,, ,,	·25
,, 7 ,, ,, ,, ,,	1·31	,, 16 ,, ,, ,, ,,	·22
,, 8 ,, ,, ,, ,,	1·	,, 17 ,, ,, ,, ,,	·20
,, 9 ,, ,, ,, ,,	·79	,, 18 ,, ,, ,, ,,	·26
,, 10 ,, ,, ,, ,,	·64	,, 20 ,, ,, ,, ,,	·13
,, 11 ,, ,, ,, ,,	·53	,, 22 ,, ,, ,, ,,	·11
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,, 13 ,, ,, ,, ,,	·38		

—"Photo Beacon," Feb., 1906, p. 44.

Depth Simplified.—C. Welborne Piper, in further reference to articles in "B.J.," August 21 and 28, 1903, gives the following rule for depth calculations:—

Knowing the hyperfocal distance for the stop in use, and the distance of the object in sharp focus, if we divide the product of these two distances by their sum, we arrive at the distance of the nearest object in focus; while if we divide their product by their difference, we get the distance of the farthest object in approximate focus.

As an example, let us consider the following problem: Suppose we are focussing with a 6 in. lens at *f*/6 on an object 10 ft. away. What are the respective distances of the nearest and farthest object in focus? Taking 1-100 in. as the circle of confusion.

The depth constant for the lens is equal to $6^2 \div 1/100 = 300$ ft. The hyperfocal distance for *f*/6 is therefore 300/6, or 50 ft.

When focussing on 10 ft. the limit of near depth must then be

$$\left.\frac{50 \times 10}{50 + 10}\right\}$$ or 8 1-3 ft., and the limit of far depth must be

$$\left.\frac{50 \times 10}{50 - 10}\right\}$$ or $12\frac{1}{2}$ ft.

When we focus on infinity the nearest object in focus is at the hyperfocal distance, and depth extends from that distance up to infinity.

The hyperfocal distance is always equal to the focal length multiplied by the diameter of the aperture, and divided by that of the circle of confusion.

When we focus on the hyperfocal distance the nearest object in focus is at half the hyperfocal distance, and the farthest at infinity, so that depth extends from half the hyperfocal distance up to infinity.

When we focus on half the hyperfocal distance, the nearest object in focus is at one-third the hyperfocal distance, and the farthest at the hyperfocal distance, so that if we represent the hyperfocal distance by H., depth extends from H/3 up to H. when focussing on H/2.

Similarly, if we focus on H/3, depth extends from H/4, up to H/2; or if we focus on H/4 it extends from H/5 up to H/3.

Generally, if we focus on a distance equal to H/n, depth extends from H/(n + 1) up to H/(n−1). Therefore a series of distances equal to infinity, H, H/2, H/3, H/4, H/5, etc., is a series of distances of consecutive depths, such as when we focus on any one, then depth is limited by the two adjoining distances. This is the fundamental principle upon which all depth indicating devices, such as the Cornex index, are devised. The rule for finding a series of consecutive depths is also very often of use in ordinary work, as it frequently happens that the distance on which we focus is as nearly as possible some definite fraction of the hyperfocal distance.

If we focus on any distance equal to U., then, if H. is the hyperfocal distance for the stop in use, depth extends from H.U. (H. + U.), to H.U. (H—U.)—"B.J.," Dec. 22, 1905, p. 1004.

Depth and the Sine Condition.—C. Welborne Piper points out that angular aperture is the only factor commonly taken into consideration in calculations concerning depth; but it is generally forgotten

that these calculations only consider the angular aperture from one arbitrary and unpractical point of view. The existence of Gauss planes is assumed, and this assumption compels us to regard the intensity of the lens (or ratio of aperture to focal length) as equal to twice the tangent of half the angular aperture. As a matter of fact, this is not the case, excepting in very unusual conditions. The actual existence of Gauss planes is avoided as far as possible by the lens designer, who aims at fulfilling the sine condition, which condition introduces an approximately spherical virtual refracting surface instead of a plane one. If the focus is the centre of this spherical surface then the intensity equals twice the sine of half the angular aperture instead of twice the tangent, which means that the angular aperture is increased and the depth diminished. It is, therefore, possible for two lenses of equal intensity to have different angular apertures, and on that account to show different qualities as regards depth. Thus a very highly corrected anastigmat in which the sine condition is fulfilled must show less depth than another lens in which that condition is ignored. In the case of a single landscape lens the virtual refractive surface may even be convex to the image, and in such a case the angular aperture is diminished, and the axial depth attainable may be increased beyond that allowed for by calculations.

It does not appear that this factor alone is sufficient to account for the considerable difference commonly observed in the depth given by anastigmats and rectilinears, but it must certainly be a contributing cause of variation.—"B.J.," Feb. 16, 1906, p. 125.

Focussing Scales.—A simple geometrical method of designing a focussing scale for a hand camera is as follows:—

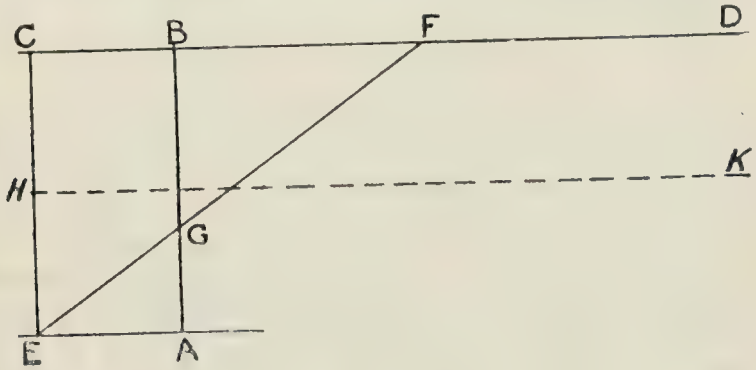


Fig. 1.

First ascertain the infinity mark by focussing on a distant object. If the distance is 500 times the square of the focal length, the infinity mark can be fixed within 1-500 in. of its true position. Next ascertain the extension of the camera beyond the infinity mark when focussing on an object at some definite small distance from the front principal focus of the lens, say, for example, 5 ft. This gives the scale length from the mark representing infinity to that representing a distance of 5 ft. Let this scale length be represented by the line

A B in Fig. 1, A being the infinity mark and B the 5 ft. mark. Through B, and at right angles to A B, draw the straight line C B D. Then take any convenient scale of feet (a small scale, such as $\frac{1}{8}$ in. or 1-16 in. to the foot, is best), and from B to C set off a distance of 5 ft., which is the distance represented at B. In the figure, B C equals 5ft. on the scale of feet. Next from C draw C E parallel to B A, and from A draw A E parallel to C B D. These two lines intersect in E, and they complete the geometrical construction. Now suppose we wish to put a mark on the scale A B representing a distance of, say, 14 ft. From C set out along the line C B D a distance, C F, equal to 14 ft. by scale, and join E F. The line E F cuts A B in G, which is the position on the focussing scale of the mark representing 14 ft. It is thus possible to represent any distance whatever, within reason, on the focussing scale A B, and distances less than 5 ft. can be shown if A B is produced.

If very long distances are required it is most convenient to set them out, not on C D, but on a parallel line, *H K*, halfway between C D and A E. In this case, if an $\frac{1}{8}$th scale is used for C D a 1-16th scale should be used along the new line, *H K*, all measurements being made from *H*. If, however, two scales are not available, one may be used, the distances being halved along *H K*. For example, sup-

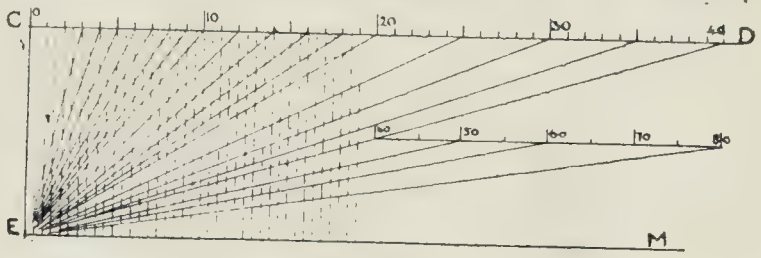


Fig. 2.

pose we wish to mark the focussing scale for 40 ft. If C D is not long enough to permit a distance of 40 ft., to be set out along it with a $\frac{1}{8}$th scale, we can either set out 40 ft. on *H K*, with a 1-16th scale, or 20 ft. on the same line with the $\frac{1}{8}$th scale.

The advantages of this method of dividing a focussing scale are obvious. There are no troublesome calculations, and one is absolutely unfettered in the choice of distances, as any one distance can be shown just as easily and accurately as any other distance.

By a slight modification, a diagram serving as a universal focussing scale adaptable to any lens is easily produced. In Fig. 2 the line C D is divided into a scale of equal parts representing feet, and from various selected points on that scale lines are drawn to the point E, which is situated vertically under C. To use this scale, find by test in the camera the length of the focussing scale between the infinity mark and any other mark representing a near distance of, say, 5 ft. Then tick off that length on the edge of a strip of paper, and lay the strip on the diagram parallel to E C, and with the infinity mark on the line E M (which is parallel to C D) and the 5 ft. mark on the line joining E to 5 ft. on the scale C D. One can then tick off on the slip the intersections of the various lines radiating from E, and mark

the ticks with the distances given on the scale C D. A supplementary intermediate scale (constructed as before described) gives the distances from 40 ft. to 80 ft. In making such a diagram as this the exact distance from C to E is of little consequence. If insufficient to admit the paper scale made in the camera, the dimension lines radiating from E may be produced upwards. The vertical dotted lines are simply to facilitate placing the paper slip parallel to C E.—"B.J.,".June 1, 1906, p. 422.

TELEPHOTO LENSES.

Carl Zeiss has patented a lens of the telephoto class in which a wide range of focal length is sacrificed (except under certain special conditions) for spherical, chromatic, and astigmatic correction at a relatively large aperture. In its simplest form, the new objective consists of two simple lenses, a crown glass meniscus as the positive,

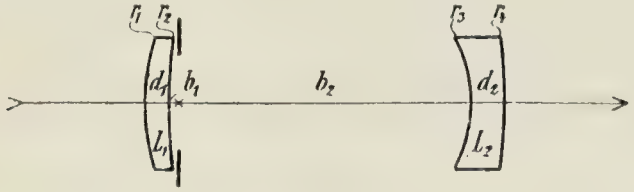


Fig 1.

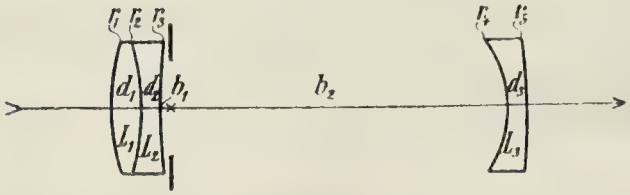


Fig. 2.

and a dispersive lens as the negative element. Satisfactory spherical, astigmatic, and orthoscopic correction is attained herewith. As to chromatic correction, comparatively large aberrations

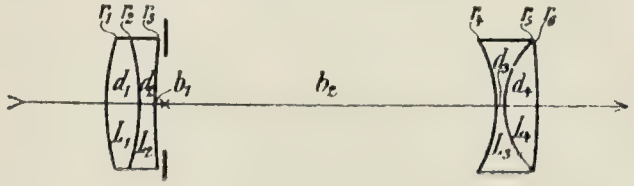


Fig. 3.

must still remain, so long as the choice of glasses is restricted to those now obtainable. These aberrations are, however, innocuous for several purposes. Chromatic correction is at once attained when both elements are individually corrected chromatically. Without detriment to the other corrections, the extinction of the chromatic

aberrations can, however, be almost entirely accomplished by constructing either the front or the back element of two lenses (separated or cemented). By such a three-lens formation of the new objective, all the known errors of the image can be removed to such

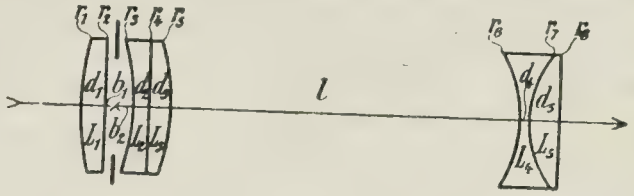


Fig. .

a degree as to suffice for many purposes. Fig. 1 is an example of the lens, with spherical and astigmatic, but not chromatic, correction, consisting of two simple lenses. In Figs. 2, 3 and 4 all these corrections are made.—Eng. Pat., No. 4,523, 1906; "B.J.," Aug. 24, 1906, p. 673.

LENS TESTING AND MEASUREMENT.

Measuring Effective Aperture of Lenses.—Martin suggests a modification of Steinheil's old idea. The lens should be screwed to the camera, and sharply focussed on a very distant object. The focussing screen should now be replaced by an opaque card, in the centre of which is punched a pinhole. The eye should be placed here, and a measure laid across the front of the lens, when the effective diameter can be at once read off, and assuming that the focus is known, the ratio aperture can at once be found; this method dispenses with the use of bromide paper and a dark room, as in Steinheil's method, as it can be carried out in the brightest light.—"Eder's Jahrbuch," 1905, p. 26.

Finding Focal Length.—Dr. G. Lindsay Johnson suggests a new and rapid method, which involves no calculation. He points out that if we focus on two objects at an infinite distance, adjusting the camera so that one of the two images falls on the lens axis, then the distance between the two images is equal to the focal length, if the objects subtend an angle at the lens of 45deg. If the objects subtend an angle of 18deg. 26min., or one of 26deg. 34min., then the separation of the two images is either one-third or one-half the focal length. If no objects subtending these angles are to be found, the angle between two convenient objects can be measured; the tangent of that angle is then a constant by which the distance between the two images can be divided to find the true focal length. —"Phot. Journ.," Aug., 1906, p. 300.

As regards the distance or number of times the focal length fixed upon when testing lenses, it is pointed out that the rule for finding the minimum distance, which may be taken as "infinity," is to divide the square of the focal length by the maximum permissible displacement of the image. Thus, taking 1-100in. as this latter, "infinity" for a lens of 20in. focal length is 20 x 20 x 100 equals 3,300ft.—"B.J.," Aug. 24, 1906, p. 662.

Camera Accessories.

A Hand-Camera Suggestion.—Rev. A. E. Bloxsome Day suggests an accessory to ordinary hand cameras, which would give many of the advantages of the reflector camera without many of its drawbacks. It consists of an attachment on the lantern slide-carrier principle. The usual focussing screen and dark slide should be placed side by side, and should be made to change places by a simple sliding movement, which would draw the shutter of the slide at the same time as it displaced the focussing screen. Dallmeyer's patent studio attachment is on this principle, but is, of course, only applicable to large studio cameras. If the carrier were made to fold in the centre it need not take up more room than an ordinary dark slide. When unfolded, it could be clipped on to the back of the camera, and the slide and screen inserted side by side. The focussing screen should have a folding hood, as is usually the case with hand cameras. The subject could then be rapidly focussed and composed on the screen, and then the slide or magazine pushed along till it took the place of the ground-glass, and the shutter be released. If the shutter were a blind attached either to the carrier or the back of the camera, the same motion that displaced the focussing screen and opened the slide might also release the shutter. Thus one movement after focussing would serve to do everything. The writer sums up the advantages of this method as follows: (1) The attachment could be fitted to any existing hand camera with open back; (2) would not interfere with the use of any lens of whatever focal length; (3) would do away with moving mirrors, extended hoods, and complicated linkings-up of mirror and shutter; (4) would be very much lighter, cheaper, and simpler than a reflex camera, and yet would do everything a reflex can. Lastly, it need only be attached and used when required.—"Phot.," March 27, 1906, p. 247.

Fine Focussing Screens.—A series of three screens for general and special work is obtained as follows:—Take three extra-rapid plates and immerse them without any exposure at all in any non-staining developer free from bromide. At the end of five minutes remove two plates and fix and wash them in the usual way. At the end of twenty minutes remove the third plate from the developer, and fix and wash that also. Next iodise this third plate together with one of the others in a solution of iodine in potassium iodide. When the action is complete, rinse the plates and bleach them in dilute ammonia. Then wash and dry. Finally, take the remaining plate and immerse it in a solution containing 10 grains of potassium bichromate, and 5 grains of hydrochloric acid to every ounce. When the chlorising action is complete, rinse the plate and put it into a fresh plain hypo fixing bath for ten minutes; then wash well and dry. You now have three screens of different degrees of density. No 1 is a dense iodide screen, No. 2 a thin iodide screen, and No. 3 a thin "chromium" screen.

No. 1 screen will be an excellent substitute for the ground glass in all ordinary work. It can be used without a magnifier or with one,

and in either case it will show detail that would not be visible on a screen of ground glass.

No. 2 (the thin iodide screen) cannot well be used without a magnifier, but while it is too nearly transparent to permit focussing with the eye alone, it shows enough grain to render the use of the magnifier easy. There is no accommodation difficulty, and the detail visible on the screen is a revelation to those who have never used anything but ground glass. This screen is of special value for indoor work, such as architectural interiors and copying.

No. 3 (the chromium screen) is quite useless without a magnifier, being almost transparent to the eye. But with the magnifier a very fine grain becomes visible, and as it is perfectly easy to keep this grain and the image in focus at the same time there is no accommodation difficulty. This screen is a substitute for clear glass, and is especially adapted for copying and for low power photomicrography. For high-power work it does not seem possible to find any good substitute for clear glass, but with moderate powers the No. 3 screen seems to show almost as much detail as the clear glass, while it has not its disadvantages. The screens can be ruled in pencil or with fine cuts to give datum marks. We prefer a cross ruling of fine cuts made with a lancet, but this is only a matter of personal choice. If the cuts are adopted it is as well to give the screen an after coating of celluloid varnish. The surface is somewhat readily abraded in the case of No. 2 and No. 3 screens, hence they should be carefully used.

It must be remembered that no fine grain screen shows such a bright image as ground glass. In comparison the image looks dull, but this is a very minor matter, and the extra detail visible far more than compensates for the loss of brightness.—"B.J.," March 30, 1906, p. 242.

Dark-Slide Shutters.—Dr. Neuhauss finds that aluminium dark-slide shutters emit radiations which spoil plates, and that varnishing does not prevent this action. The ordinary ebonite shutters are permeable by violet and ultra-violet light, and they frequently give rise to electric markings. Wooden shutters are also transparent to sunlight, and fresh glue and varnish coatings will also fog plates. From numerous experiments with zinc and other metals the author strongly recommends brass for the shutters—this neither emits nor transmits any rays whatever.

In connection with this subject, it may be pointed out that Professor Piltchikoff, of Charkow, has been investigating the peculiar radiations of metals, and finds that some metals emit rays which affect silver bromide like light, and that others restore it to its original condition. The former radiation he proposes to call "positive," and the latter "negative." Cadmium and zinc are positive, and osmium and tantalum negative, whilst copper and brass emit a neutral radiation, and mercury and gold none at all. When the air is thoroughly dried by phosphorus pentachloride there is practically no radiation.—"Phot. Rund.," V., 1906, p. 57.

Emanations from Dark Slides.—H. E. Edmeads employs the following method for getting slides into good condition: Directly

the new slides have been received from the maker they are opened out as wide as will allow them to stand on their edges, thus exposing the inside to the air, they are then placed on a shelf, or anywhere out of harm's way, where a current of air will circulate round them, but not in a position for the sun or damp to get at them. They are allowed to remain in this way until the peculiar smell, which is noticed upon opening a new slide, has entirely gone. This may perhaps take several days or weeks to accomplish. Should the slides be required for use during this airing process, they should be carefully dusted before placing the plates in them, and after the exposed plates have been dealt with the slides must be opened out and placed back again on the shelf as before. It it advisable during this time to be careful to remove the plates from them as soon as possible after exposing; but when the smell has been eradicated no harm will come to the plates even if left in for a time.—"B.J.," March 30, 1906, p. 256.

INSTANTANEOUS SHUTTERS.

Timing Shutter Speeds.—Harvey Collingridge gives an analysis of the motion of a pendulum for the purposes of shutter-speed determination. The speed of a pendulum bob in feet per second is

$$2\sqrt{gl\left(\sin^2\frac{\beta}{2}-\sin^2\frac{\theta}{2}\right)}$$

Where g = force of gravity at the place of experiment, 32.2 is sufficiently approximate.
l = length of pendulum in feet.
β = angular displacement from vertical of bob at its highest position.
θ = angular displacement from vertical of bob for position at which speed is required.

From this formula a table of the speeds of the bob over each 5deg. of arc can be calculated; also the total period of the pendulum.—"B.J.," May 4, 1906, p. 351.

FOCAL-PLANE SHUTTERS.

The report of the International Congress of Photography (held at Liége, July, 1905) recommends that every shutter should be tested for the speed of the blind on its release and when the exposure is finished; and the mean speed should be then deduced. The difference may amount to 40 per cent., which is stated to be an advantage when a considerable amount of sky is included in the picture.

If the speed of the blind is more than 2 to 3 metres per second, distortion of the object is negligible.

If the edges of the aperture are composed of material, it is not advisable to reduce the same below 1mm.

Variation of the distance between the blind and the plate affects the efficiency and the useful aperture, and the increase of the latter is approximately $\frac{e}{f}$, e being the distance between the blind and

plate and f the extension of camera; in most cases this is about 2mm., and is negligible. As regards efficiency, Colonel Moessard gives the following formula: $R = 1 - \frac{c\ o}{a\ f}$, in which a is the width of the blind aperture and o the diameter of the lens. In most cases, from a theoretical and mathematical point of view, when the distance is as stated above, its action on the efficiency is of no moment. Practically, on the contrary, the influence may be considerable as regards the quality of the negative. An aperture the edges of which are brilliantly illuminated may diffuse some of the light over the plate; to reduce this diffusion the distance must be decreased. M. Sigriste believes also in the production of a species of fog due to diffraction, which becomes greater the greater the distance between blind and plate. To calculate the speed it is only necessary (to obtain an approximately correct result) to divide the width of the slit in millimetres by the speed of the blind in metres per second. The method suggested of testing the shutters is to use an opaque disc, pierced by six apertures, which should be rotated ten times in a second; an examination of the images of the apertures in the disc will give the speed of the shutter at various stages. The data recommended to be given with shutter should be the speed at the moment of release, and when the blind is down, in metres per second, the ratio of these two speeds and the mean speed. The maximum and minimum useful widths of the slit should be also given, the mean distance of the blind from the plate and the times of exposures for every 10mm. slit width.—"Bull. Soc. Fr. Phot.," Jan. 1, 1906, p. 3; "B.J.," March 30, 1906, p. 244.

Artificial Light.

Enclosed Arc Lamps.—C. H. Hewitt gives the following approximate figures as the cost of running arc lamps of the enclosed "Westminster" type:—The Westminster No. 114 lamp takes 6 to 7 units per hour, and the smaller No. 111 lamp takes 3½ to 4 units. On a day load at 2d. per unit the cost is thus seen to be from 1s. to 1s. 2d. per hour, or 7d. to 8d. per hour respectively. To this must be added the cost of the glass cylinders and the carbons. With care the cylinders should last a long time. If two new carbons are fitted to the lamp it should run easily for three hours without renewal, though in that time the lower carbon may need raising once or perhaps twice. The enclosing of the arc effects a vast economy in carbons. Using the smaller or No. 111 lamp, therefore, the cost may be estimated at 8d. for current, and, say, 4d. for carbons and glass cylinders, which is an ample allowance. Taking five minutes as sufficient time for an ordinary sitting with two or three exposures, the cost works out at a penny per sitter.

As regards installation, if one lamp is to be used for printing and enlarging, as well as portraiture, the smaller size will be the more convenient. It may be suspended in an umbrella-shaped reflector,

the light being covered in by means of a wire framework, shaped like an inverted beehive, and covered with tracing linen cut in gores and lightly sewn on. Fig. 1 roughly indicates the arrangement shown in section. The wire umbrella, six or seven feet across, is covered with taggers or with thin sheet zinc from the top to A B, the remaining portion being calico tightly stretched, and the whole coated inside with white paint or distemper. The wire bee-hive is attached at A by two hooks to rings on the umbrella, and at B by one hook, so that it may be unhooked here and allowed to swing down to allow of access to the lamp for replacing or adjusting carbons. At D a three-fold screen, eight feet high and covered with white blotting paper, is placed, giving ample side light and obviating too great a concentration of light. On the shadow side of the sitter another

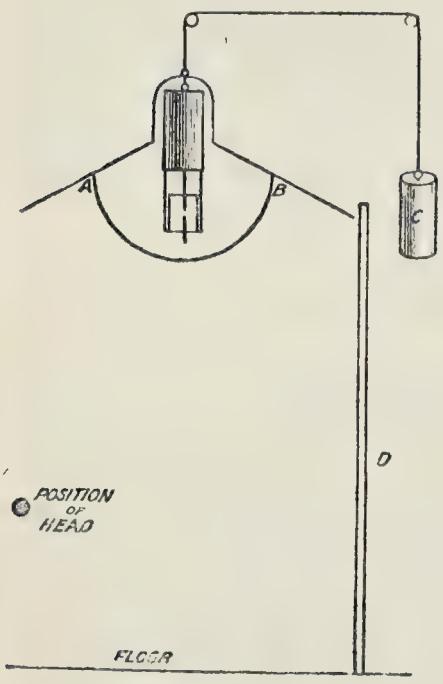


Fig. 1.

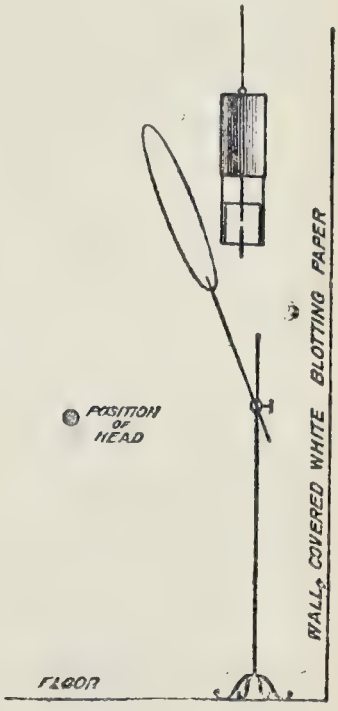


Fig. 2.

large reflecting screen of white blotting paper is placed to illuminate the shadows. By its size and by being placed at the right distance from the sitter false reflexes in the eyes are, to a great extent, avoided.

Instead of the bee-hive shaped diffuser the lamp may be left entirely open and an ordinary tracing linen head screen employed to prevent the direct undiffused light reaching the sitter. (See paragraph "Fancy Dress Balls" in Section III.)

C is a counterpoise weight, which allows of the lamp being raised for full length standing figures. The lamp may, of course, be hung at a fixed height and from a travelling pulley, but this is, in the majority of studios, quite unnecessary.

An alternative arrangement, which has worked exceedingly well, is to suspend one of the smaller size lamps about three feet from the wall, which is covered with white blotting paper or a white lantern sheet, simply using a large tracing linen head screen for diffusing, as shown in Fig. 2. Working in this way the lamp may be very conveniently lowered for printing, or the cable may be detached, the lamp lifted down, and taken to the enlarging lantern or the printing room.

In portrait work it is most important to use a very efficient lens shield, or the plates will be badly fogged by light striking the lens. This, of course, should be done with daylight work, but it is much more essential where the light is in front of the lens rather than at the side, and with artificial light the close proximity of the source of the light to the sitter often brings the lamp only just outside the field of view. Possibly the best form of lens shield is a kind of box, the front of which may be moved nearer to the lens, or further away, as required. The opening in the front, reversible like the back of a camera, for upright or oblong portraits, should be arranged to allow nothing to be seen on the focussing screen except the required picture.—"B.J.," March 2, 1906, p. 164.

MAGNESIUM LIGHT.

A Magnesium Wand.—A. W. H. Weston favours the use of a magnesium lamp on the end of a long cane, leaving an end about twelve inches long, which is bent to form the clip *c* for the mag-

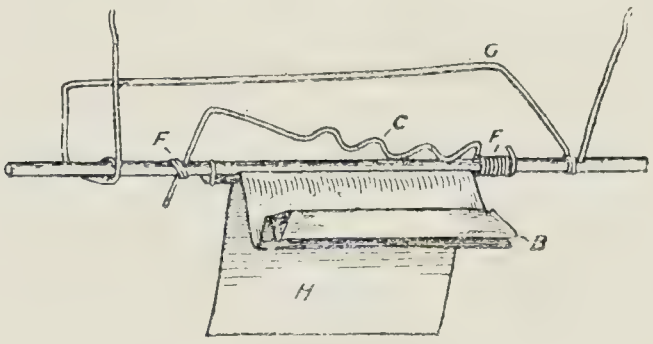


Fig. 1.

nesium ribbon. It will readily be seen how this clip acts, and how it is held down by the ring F in Fig. 2. The addition of the wire frame G and the bag A is optional, but if used it will trap a lot of

the magnesia fumes resulting from the combustion of magnesium ribbon. It is used wet, and held in place with the rings S S.

To prepare the wand for use, cotton wool is placed in the pocket B and saturated with methylated spirit, the bag dipped in water, wrung out and slipped over its framework G.

A quantity of ribbon having been cut up beforehand into lengths of about two inches, three or four pieces are placed in the clip *c* (taking care to bring the ends about a quarter of an inch above and

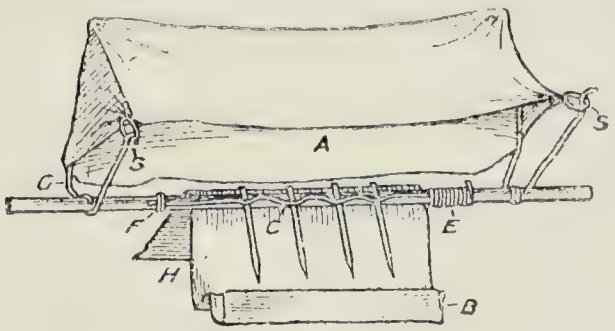


Fig. 2.

directly over the spirit lamp), and the wand is charged.

While focussing, the wand can be conveniently rested on the backs of two chairs. Even if lighted, the weight of the tin H keeps the lamp in a horizontal position and the flame away from the ribbon. Having focussed by the flame of a candle, and everything being ready for the exposure, the spirit lamp is lighted and the lens uncapped.

Then, lifting the wand fairly high up, twist the handle and the flame is brought directly underneath the magnesium ribbon. During the time that the ribbon is burning (which is about four seconds) the wand must be waved about in such a way as to secure a suitable lighting. The flame should not be moved in a straight course, but with an up and down zig-zag or circular motion, thus softening all shadows, either vertical or horizontal.—"Pgm.," March, 1906, p. 77.

Flashlight.—A smoke trap for flash lamps is patented by J. Fielder in the form of a closed water-tight and smoke-tight bag, which is wetted to render it uninflammable. Eng. Pat. No. 25,750, 1905.—"B.J.," Feb. 2, 1906, p. 92.

MATERIALS.

Contraction of Paper Prints.—E. J. Spitta gives the results of measurements made of prints prepared on the different papers, and measured before and after the usual operations. The dry prints were measured in each case, and it was found that contraction took place without exception.

TABLE OF PAPERS.

	Contraction in 100 mm. of the paper.	
	Across.	With the grain.
Ilford bromide (thin)	0.8 mm.	0.8 mm.
Wellington and Ward bromide ...	0.35 mm.	0.35 mm.
Nikko	0.3 mm.	0.4 mm.
Barnet slow enamel	0.25 mm.	0.3 mm.
Velox	0.3 mm.	0.55 mm.
Platona	0.6 mm.	0.5 mm.
Platinum	0.5 mm.	0.6 mm.
Aristo (collodion)...	0.6 mm.	1.0 mm.
Carbon (single transfer)	— mm.	1.1 mm.
Argentic chloride (Morgan and Kidd)...	0.4 mm.	0.4 mm.
Ilford P.O.P.	0.45 mm.	0.5 mm.
Imperial P.O.P.	0.3 mm.	0.25 mm.
Paget self-toning	1.0 mm.	0.4 mm.
Imperial self-toning	0.35 mm.	0.6 mm.
Negative paper	0.4 mm.	0.4 mm.
Positive paper (Wellington and Ward)	0.6 mm.	0.5 mm.

In the table the terms "with" and "across" the grain are only assumptions, meaning that the contractions were taken across or with the lengths of the papers as found in their respective packets. Coating the paper with a 1:30 solution of gelatine before printing was found to reduce the contraction in some cases, but not in others. The contraction was found to continue for a week or a fortnight after making the prints.—"Phot.," Nov. 28, 1905, p. 430.

Raines and Co. commenting on Dr. Spitta's results point out that when the positive print is wet it stretches (as Dr. Spitta, of course, admits), and it is in this state that, under ordinary circumstances, it is mounted; and provided that the mount is strong enough to withstand the strain of the effort to contract during drying, the print will be found to be appreciably longer in the direction of the grain than it was when dry previous to mounting. It is owing to this stretching that the portrait photographer is able to "lessen the individual peculiarities" of his models, but, unfortunately, the same stretching takes place when such alteration is not desirable.—"Phot.," Dec. 5, 1905, p. 453.

For overcoming contraction difficulties by mounting on a rigid support, see under "Multiple Gum."

Chemical Testing of Photographic Papers.—A series of tests to identify wood pulp in a paper and to ascertain the presence of oxidising substances, hydrogen peroxide, organic substances, ammonia, sulphur and sulphides, metals, and radio-active bodies is given in "B.J.," May 25, 1906, p. 405.

III.—PHOTOGRAPHING VARIOUS SUBJECTS.

PORTRAITURE.

Fancy-Dress Balls.—The method adopted by Miss Annie Bell, a student of the Polytechnic School of Photography, in making over 100 exposures at the Lord Mayor's Juvenile Ball was as follows: One of the Westminster Engineering Company's large enclosed arc lamps was suspended in a 6ft. umbrella-shaped reflector at a suitable height, and yet as near the sitter as possible so as to give the maximum illumination. A three-fold screen covered with white blotting-paper was so arranged as to increase the illumination towards the sitter, and at the same time cut off direct light from the camera and lens, thus avoiding any danger of flare and the use of a focussing cloth. The shadow side was lighted by a blotting-paper reflector of large size. A diffusing screen a yard in circumference, covered with tracing linen, was placed to cut off direct rays from the head and upper part of the sitter, and to allow uninterrupted illumination of the feet and floor, and of the shadow side reflector. The large amount of reflected light from the three-fold screen prevented the least trace of any shadow of this diffuser being present. The plates used were 250 H. and D., and with a Ross Homocentric lens at *f*/5.6 the exposure was $\frac{1}{3}$sec., or practically a studio snap.—"B.J.," Jan. 12, 1906, p. 23.

Portraiture by enclosed arc lamp by C. H. Hewitt. See under "Artificial Light."

Telephoto Portraiture.—Ernest Marriage, in some notes on the use of the Dallmeyer-Bergheim lens, remarks on the good feature possessed by telephoto lenses in general of massing the background free from obtrusive detail, thus subordinating even pronounced outdoor backgrounds to the figure or portrait.—"A.P.," March 6, 1906, p. 193.

Ernest Marriage dwells on the advantages of using the telephoto lens in portraiture chiefly on account of the good drawing and on the fact that the sitter's position, at a considerable distance from the apparatus, makes it possible for any pleasing and comfortable pose to be assumed without troubling the sitter as to arrangement in one plane equidistant from the lens. It is an advantage to use a portrait lens with the adjustment for separation of the lenses of the back combination; any desired amount of diffusion may thus be introduced by a turn of the cell. Depth is thus secured without sacrifice of rapidity.—"A.P.," Feb. 13, 1906, p. 137.

Striking Lighting Effects.—H. Essenhigh Corke explains how to reproduce the effect of a smoker lighting a cigarette by a match held in his hands. He lights the sitter sideways from a window before a dark background, and provides a loop of magnesium ribbon (about two inches long) for use instead of a match. An assistant lights

the ribbon and blows away the smoke of the burning metal, which would produce (if not dispersed) an ugly streak of light above the hand. The exposure should be about ½ to 1 sec. at *f*/22, the uncapping of the lens being made just as the magnesium is lighted. Over-exposure destroys the concentrated effect.—"Phot.," June 12, 1906, p. 466.

Photographing the Dead.—The "Lancet" calls attention to the methods of post-mortem photography adopted by Dr. Minovici, who has found it possible to impart a characteristic expression to the face of a dead person by the use of artificial eyes, dark or light, according to the colour of the individual's iris. A natural appearance can be given to the orbital opening by introducing beneath the lids an extemporised speculum of lead foil or by fixing the upper lid to the ball of the eye means of a fine pin. The jaws can be drawn together with thread, and by appropriate arrangements of pins various emotional expressions can be given to the face. Even in cases where putrefactive changes have occurred, if there has been no actual loss of substance, the features can be in a large measure restored if the gases in the areolar tissues are evacuated through suitable incisions in the scalp and in the buccal mucous membrane. By the application of these methods in a case where the body had been immersed in water for six weeks Dr. Minovici succeeded in getting a photograph sufficiently life-like to establish the individual's identity.—"B.J.," May 25, 1906, p. 409.

Eyes.—W. Percy Barringer advises that the sitter should be posed facing the camera, and looking directly into the lens, the light falling from behind the instrument. Too strong a light should be avoided, a medium, even illumination being best. Place the sitter for indoor work about six or eight feet from the window, and beware of reflecting or very light surfaces near at hand, as the retina of the eye is itself a reflector. Do not let your subject "glare"—a characteristic expression is your ideal, and to obtain this the exposure must be short but ample for full detail. Develop with a fairly diluted solution, to obtain softness, and print on a fine matt paper, the glaze of P.O.P. preventing one from taking in the whole picture at a glance.—"Focus," Feb. 28, 1906, p. 216.

Midget and Stamp Pictures.—A. E. Warren describes his apparatus for obtaining sixteen and more exposures on one plate.—"Cam. Craft," Dec. 1905, p. 257.

LANDSCAPE.

Alpine Photography.—Louis J. Steele in a lengthy article on the use of a camera in the Alps comes to conclusions as follows:—The camera must be carried by the photographer as the assistance of a guide or porter cannot be had at many points of the ascent. A revolving back for horizontal or vertical pictures is a convenience as obviating the chance of dropping an essential part. On account of the searching effect of light at high altitudes, and owing to the large amount of reflected light from snow and ice, a focussing cloth should, whenever possible, be used as a protection during exposure. Such a cloth should be made in the form of a bag, provided with elastic at one end for securing round the body of the camera, the

other end being sewn to allow a hole underneath for the admission of one's head for purposes of focussing, etc. This device will be found most useful in a high wind. A foreground shutter will, under many circumstances, be found useful in Alpine photography.

With regard to the lens, the most useful all-round instrument is one of the modern anastigmat type of about 5½ ins. focus for a ¼-plate camera and working with a maximum aperture of about *f*/6.3. The camera should be provided with an extension to enable the several combinations of such a lens to be utilised. This will prove most useful for many mountaineering subjects. It will be found an advantage if the idle lens can be stowed in the front of the camera when not in use.

Although it is not so essential to employ a lens working at a large aperture, yet such an instrument would prove of great utility in enabling one to photograph moving figures at close quarters on a mountain, and also to utilise a colour screen with isochromatic plates in a hand camera.

For a tripod, one of aluminium with telescopic and adjustable legs, and preferably with an universally moving head (for adjustments after the legs have been got in position) is recommended.

When using a stand on snow or ice it is well to remember that the points of the tripod may have been warmed by the sun; care should therefore be taken to wait a few moments until the metal points have reached a sufficiently low temperature to prevent them sinking in, and thus cause a motion of the camera during exposure. A useful plan is to fix discs of cork or other suitable material to the points of the tripod.

It may frequently happen on a mountain that a time exposure will have to be made in high wind, the velocity of which may be considerably higher than what we are used to on the plain. Under such conditions it will be found useful to steady the camera by means of a cord fixed to the tripod head or legs, and kept taut by passing it under the foot and holding the loose end in the hand.

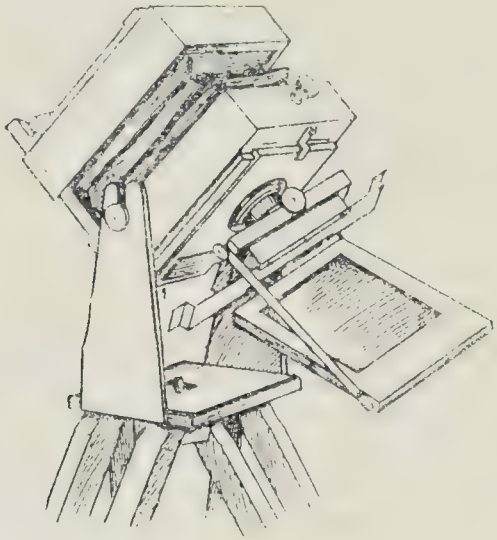
In cases where a time exposure is necessary and a stand is not available, the ordinary ice-axe carried by mountaineers will be found of great utility as a support—still more so if a suitable clip is carried for securing the camera to the head of the ice-axe, the point of which is rested on some solid foundation.

Even in the case of instantaneous exposures it is recommended that this device should be made use of, and that the camera should find some additional support to that of one's hands, for, owing to the unsteadiness of one's hand, the higher rate of breathing, and the increased action of the heart in mountaineering, there is a considerable risk of moving the camera during exposure, which can be obviated by a judicious use of the ice-axe.—"P.N.," May 18, p. 386, and May 25, p. 408, 1906.

Cloud Studies.—A. W. Clayden, author of "Cloud Studies" (London: John Murray, 12s.), advises the following procedure for obtaining accurate photographs of cloud structures: A slow plate (Mawson's photo-mechanical is used for his own studies) and a black-glass mirror; photographing the reflection from the black glass

instead of pointing the lens to the sky. Plate glass, backed, is unsuitable for the mirror.

For general cloud-work, Mr. Clayden recommends using a slow plate, small lens aperture, yellow light-filter or black mirror, or



two or more of these in combination, in order that the exposures may be long enough to be easily controlled. The black mirror should be at an angle of 53deg. to the axis of the lens. Mr. Clayden's own developer is pyro-ammonia, and tentative development is recommended.—"Pgm.," Jan., 1906, p. 53.

Cloud Photography.—A paper, by A. W. Clayden, before the Photographic Convention, 1906.—"B.J.," July 20, 1906, p. 569.

Snowstorms.—Pictures of this kind are best made when the snow is falling slowly in large flakes, and a dark background of buildings or other objects serves to make each separate flake clearly seen. By far the most common trouble is caused by flakes of snow passing near the lens and making blurred streaks. The only way to avoid this is to photograph through an open door or window, or else set up the camera under an awning or open shed, so that the nearest flakes are at least two yards from the lens. The lens should be focussed on some prominent object in the foreground, and the background, being thus thrown out of focus, will add to the effectiveness of the picture by carrying out the idea of indistinctness caused by the storm.—"Photo-Era," March, 1906, p. 211.

Moonlight Photography.—H. Mortimer Lamb records and illustrates experiments in moonlight photography with pictorial aims. He finds an exposure of two to three minutes at *f*/6 on "Imperial" "special rapid" plates to be sufficient for rendering the character of the scenes -i.e., as soft and shadowy outlines without detail in the shadows.—"A.P.," March 27, 1906, p. 247.

Figures in Night Photographs.—A. W. H. Weston advises the making of a very greatly under-exposed negative by daylight to get the figures, placing the plate-glass side to the lens. A careful note is made of the standpoint and the exposure at night for the lights made from identically the same spot as near as possible. The two negatives are then bound together film to film, and the combination negative, though not available for contact printing (unless made on films) is available for enlargement. Care must be taken, in the case of the daylight negative, not to include figures which come between the camera and the points where the lights will be—after dark. The lens must be used at the same extension in each case after allowing for the thickness in the glass in the daylight exposure by racking in 1-16in.—"P.N.," April 27, 1906, p. 328.

MISCELLANEOUS SUBJECTS.

Theatrical Photography.—Arthur Payne describes in detail the methods employed by him for making snapshot exposures of figures and groups under ordinary stage lighting as shortly explained in "B.J.A.," 1906, p. 691. He uses a hand camera—with focal plane shutter to obtain the greatest effective exposure—and he considers *f*/3.6 (that of the Planar) the largest useful aperture. Plates bathed in orthochrome T were found to be more rapid than any "ordinary" plate. The ammoniated dye bath given in last year's ALMANAC is satisfactory, but the plates must be used within a day or so of bathing.

For scenes of the whole stage the worker may take his stand in the dress circle; for single figures at the side of the stalls. In either case, the focus should be obtained by actual trial on the ground glass—when using such large aperture lenses it is not safe to trust to focussing scales. The focus obtained at an early stage, plates may afterwards be exposed at pleasure.

The nearer the camera to the subject, the shorter may the exposure be. The best way of judging of the amount of light on the stage is by observing the amount of light reflected into the auditorium.

Development of the plates—which are never likely to be over-exposed—is done at a temperature of 75 deg. Fahr. It is well to work without bromide, if possible, and with the developer at its maximum strength, under which circumstances, at the increased temperature, many organic developers give very grainy images. Edinol was found to be better in this respect. Formula:—Sodium sulphite, 5 ozs.; edinol, 96 grs.; sodium carbonate cryst., 2 ozs.; water, 20 ozs.

Much can be done to obtain the improved results from the thin negatives by making transparencies and second negatives from them. —"B.J.," July 6, 1906, p. 529.

Rendering Motion.—A. W. H. Weston employs a moving (rotating) camera to follow a moving object and so obtain greater sharpness of the object while blurring the background and stationary objects in the field of the lens, the device apparently being suggested by the movement of the human eye in observing a moving object. The

camera is mounted sufficiently loosely on the tripod head to move round on a spring fixed to the back (and attached also to the hind-leg of the tripod) being released. The release can be made by the pneumatic bulb of the shutter and the exposure of the plate (about 1-90th of a second), and the rotation of the camera made to take place simultaneously. The device is said to give a better suggestion of motion than is obtainable by the use of a focal plane shutter.—"Phot.," Aug. 21, 1906, p. 153.

Living Fishes.—Dr. Francis Ward, in order to avoid the under exposure of the surroundings when instantaneous exposures are made of the fish (such exposures being necessary to obtain the effect of movement and life), resorts to double or treble printing. He cleans the glass of the tank carefully, fills with perfectly clear water, introduces the fish at one end, and as he rapidly swims to the other end, makes an exposure in bright sunlight of 1-100th to 1-200th of a second, on the fastest plate obtainable, exposing four to six plates at a time, until a satisfactory negative is obtained. The latter must be fairly sharp, and, above all, must suggest motion. To procure a negative to represent the scenic portion of the photograph, he introduces into the tank stones, gravel, mud, reeds, weeds, etc., imitating as far as possible the usual habitat of the fish photographed; and on a stage behind the tank he arranges gravel, etc., for a distance of at least 6ft. He then stirs up the water in the tank until it is quite thick, then runs a stream through, and as soon as the water is clear enough to show the weeds, but sufficiently thick to obscure the distance, makes a full exposure in a good diffused light on an isochromatic plate, using a screen if the colour of weeds requires it. Finally, the fish is printed in, employing some method of composite printing.—"A.P.," June 19, 1906, 518.

Sunbeams.—John M. Dunn obtains effects of sunbeams striking through a mist or dust-laden atmosphere by working early (shortly after sunrise) straight against the light. The conditions for success are strong, well-marked sunbeams pouring through the mist, a dense dark background showing them up, a thick canopy of branches overhead screening the camera from the direct rays of the sun, and an absence of trees or branches obstructing the view. These conditions, it can be seen, are exacting, as they can be found so seldom, and when found last such a short time.—"Phot.," Sept. 18, 1906, p. 226.

Sea Birds.—C. J. King considers good stalking the secret of successful photography of birds on the sea coast. It is well to cover the face with the hand camera when approaching birds, and often necessary to wriggle, snake-like, along the ground to approach near enough to the subjects. An aid to stalking is a home-made focussing cloth, consisting of a long blue-serge arrangement lined with red Turkey twill, and drawn up at one end with strong elastic. This goes over the camera, and is long enough, when the tripod legs are spread out, to almost reach the ground, thus forming a sort of tent with the camera at the top. The photographer can conceal

himself in this "tent" whilst awaiting the return of birds to their nest.—"P. N.," Aug. 24, 1906, p. 670.

Metric Photography in Criminal Work.—Th. Dokulil describes Bertillon's metric photography, by which the positions of objects (in a room, for instance) may be perfectly determined. The camera has a constant extension of 15cm. (6in.), and to obtain sharp images of objects at different distances, lenses of different foci are used. The prints thus obtained always show the same perspective as the plane of projection is a constant distance from the projection centre. The apparatus must always have the centre of the lens 1.5m. above the ground. Two exposures are made, the camera being shifted in between; when this shift is known, the dimensions of objects may be obtained by simple construction, and a geometrical drawing of the room or place made.—"Phot. Korr.," Nov., 1905, p. 393.

Engines.—A paper on photographing engines and machines appears in "Phot.," May 29, 1906, p. 429.

Photography Underground, by M. M. Mitchell.—"Aust. Phot. Rev.," Jan., 1906, p. 3.

FLASHLIGHT.

"Magnesium Light Photography," by F. J. Mortimer (Dawbarn and Ward) deals with practical flashlight matters.

COPYING.

Reproducing Medals.—In reference to the various methods of securing good relief "Process Work" recommends several, viz.:—(1) The plaster cast; (2) spraying the medal with grey colour from airbrush; (3) Mr. Hood's method of allowing smoke from burning magnesium ribbon to reach the surface of the medal, which is held face downwards over the burning ribbon, and (4) the method of lighting with one lamp only. The last method may not be successful unless one other precaution is taken, and that is to keep the light moving to and fro and, if possible, up and down slightly, while the exposure is being made. If swinging lamps are in use, this is perhaps the simplest and best method.

To fasten the medal on the board the best method is that of W. J. Smith, at the L.C.C. School. This consists in cutting an aperture out of millboard roughly corresponding to the shape of the medal, but slightly smaller. Cut this in half, lay the medal down on the copying board, and then place one half of the millboard on each side of it. These can be wedged up closely and then pinned down with drawing-pins, so that they hold the medal fast without any danger to it, and there is no fear of shadow from projecting pins nor anything to be engraved away afterwards.—"B.J.," March 23, 1906, p. 229.

Photographing Coins.—Dr. E. Demole comments upon the usual method of obtaining good photographs of coins and medals—that is, to take a cast, colour, and photograph it. He suggests the follow-

ing method:—Place the coin or medal between two sheets of white glazed card, which should be very thin, and damped. The whole should then be placed between two pieces of thick felt and then subjected to strong pressure in a copying press. After a short time the impression of the coin is perfect. The impressions should then be lighted from one side and photographed not on to a plate, but on to smooth glazed bromide paper. The result is a negative, which is rather weak, but the reversed lettering is again reversed in the negative, and the side lighting having left the surface in comparative shadow, the face of the medal remains white or grey, as though all those parts in relief had not been illuminated, whilst the illuminated parts remain black. The result, although a negative, has all the characteristics of a positive. The lighting is certainly a little stronger and unnatural, but it is quite sufficient to give all the necessary details of the coins. The real negative is, of course, the impression on the paper, and the negative made by the lens is the positive. The catalogue of the coins of the Numismatic Society of Geneva, which number some thousands, has been illustrated by this process.—"Rev. Suisse," Mar., 1906, p. 74

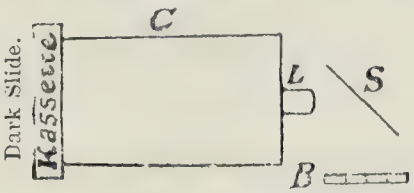
Focussing Line Drawings.—L. P. Clerc suggests the following method for ensuring critical focussing with lenses of larger aperture



when reproducing line drawings. Cut from thin card a piece the exact size of one of the Waterhouse diaphragms, and, unscrewing one of the lenses, trace on the card its maximum aperture; divide this into four equal parts and cut out the upper and lower segments, leaving them separated by a band equal to half the diameter of the lens. Then carefully blacken the stop, and insert in the lens. Every horizontal line will now be represented double, and the separation between them will be greater the distance from the sharp focus. When the focus is absolutely obtained the double lines will superimpose and form one line.—"Procédé," Feb., 1906, p. 25.

Photographing Writing and Printed Matter.—Dr. Wiedeman gives, in the "Zentralblatt für Bibliothekswesen," a very simple method of obtaining quickly a photograph of a manuscript or printed matter, and whilst this idea has been used for some years, it may be useful

to draw attention to it. A reversing mirror is placed in front of the lens, and the object is photographed on to bromide paper, which is then developed in the usual way, so that a black line appears as white on a black ground. The position of camera, mirror, and object is shown in the following diagram, in which C is the



camera, L the lens, S the mirror, and B the book, which obviously lies flat on the table. This method has been in use in the libraries of Rome, Paris, London, etc., and in Paris the bromide paper is used in rolls, and all exposures developed at once. It is obvious that this method of working is particularly valuable when a manuscript can only be retained for a short time.—"Phot. Korr.," April, 1906, p. 179.

Judicial Photography.—Dr. R. A. Reiss, in a paper read before the International Congress of Photography, says that M. Bertillon was the first to point out that when certain inks were used for writing and that when the paper, as soon as the characters were dry, was pressed into contact with another sheet of paper, there was produced of the latter invisible impression which could be rendered visible by heat. Later, Dr. Reiss completed the work and found that the effect was produced by the acid in the ink acting on the sizing, and that neutral and basic inks did not act in the same way.

Experiments were made to find a method for reproducing the invisible image without in any way damaging the documents. The paper which was suspected to contain the invisible image was pressed into close contact with a piece of P.O.P. and left in contact in the dark for from six to twelve hours. The sensitive paper was then exposed to light till it was blackened, and the writing was then clearly legible in metallic characters on a dark ground.

The defect of this method was that the characters were faint and could not be easily photographed, so another method was tried. The papers were pressed into contact as before, then the P.O.P. was exposed till the ground turned a reddish violet and then physically developed. The ground blackens, but the characters gradually appear with a metallic sheen and development should be continued till they are quite legible. The developer used was a 1 per cent. solution of pyro plus 10 per cent. of glacial acetic acid. To obtain black proofs on a white ground it is only necessary to place the back of the P.O.P. in contact with the paper containing the invisible characters.

Photographing Burnt Documents Written in Pencil.

The burnt document should be fixed on a flat piece of wood in a dark room and placed in front of the lens at an angle of about 30 deg. It should then be illuminated by a powerful incandescent

gas lamp, so that the light falls on the document at an angle of about 80 deg. The lamp should be placed at the end of the board which is furthest from the lens. If now the image is examined on the ground glass the writing will be seen as luminous, though faint, lines. On the negative the characters will appear black on a grey ground. It is necessary, of course, to use a yellow sensitive plate, and from the position of the document very small diaphragms must be used, and hence follows a very long exposure. In the positive the writing will appear in white on a dark ground. This method is of great value.

Invisible Writing on a Black Ground.

There are several commercial picture postcards which bear the pictures of old masters surrounded by a black frame. Recently a case was met with in which a criminal had used this black frame on which to write a message to his accomplice. As a matter of fact, if this black frame is written on with black ink, the writing completely disappears when dry and passes through the post without comment. To decipher the message I gave the card a coating of water colour varnish, and the writing immediately became visible and could be easily photographed.—"Revue des S. Phot.," May, 1906, p. 62.

Photographing Coloured Objects.—A. von Hübl deals with some of the so-called faults of colour-sensitised plates, and points out that these are really due to the peculiarities of pigment colours. Treating specially of greens, he proves by means of a colour top that nearly all greens have a considerable admixture of black, and cannot, therefore, be reproduced brighter than a grey; this is one reason why the red-printing negative is frequently considered defective. He also points out that whilst the spectrograph is theoretically correct it leads to very uncertain conclusions in practice, and he strongly recommends a colour chart, composed of blue, yellow, green, and red of equal saturation and purity, together with white and a grey, the latter representing the amount of black in each colour. It may be advanced against the colour chart that it can only prove the behaviour of the plate to a mixture of coloured lights, but this is exactly what the practical worker wants. It is of little interest to him whether the plate is sensitive to wave length 590 or 610; he wants to know how the plate will behave to various coloured objects, whether it can also be called colour-sensitive without a yellow screen, what intensity of filter is necessary in order to reproduce blue and yellow in a given luminosity ratio, whether it will reproduce reds, light, and so on. A chart with reproductions on various plates, with and without filters, is given.—"Phot. Korr.," April, 1906, p. 157; "B.J.," June 8, 1906, p. 446.

STEREOSCOPIC PHOTOGRAPHY.

The Laws of the Stereoscope.—M. Goderus deals at considerable length with this subject, and illustrates the same with numerous diagrams and illustrations. His chief recommendation is that the lenses should be separated in all cases by the average distance

between the eyes. The paper cannot be usefully abstracted.—"Bull. Belge," July, 1906, p. 263; "B.J.," Aug. 17, p. 648, Aug. 24, p. 669, Aug. 31, p. 690, 1906.

One-Lens Stereoscopy.—W. Salon patents a device, consisting of two glass prisms placed as near as possible to the front of the lens and enclosed in a dull black casing. The two rectangular

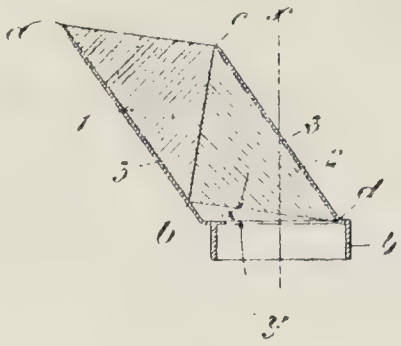


Fig. 1

equilateral prisms 1 and 2 are so placed together that their hypotenuse surfaces *a b* and *c d*, are parallel. The length of the small sides, *a c* or *b d* or *c b*, is preferably 34mm.—that is to say, a little

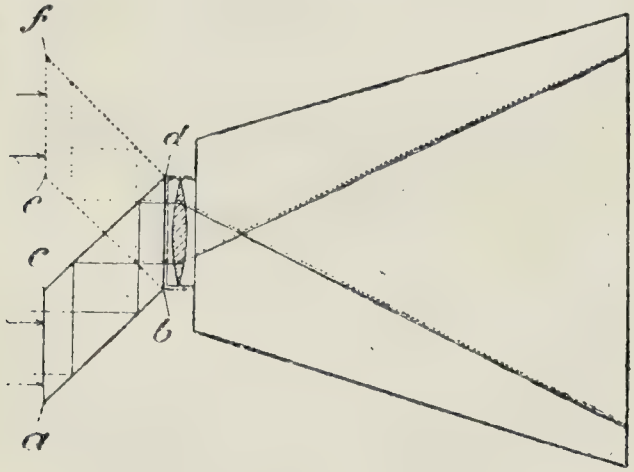


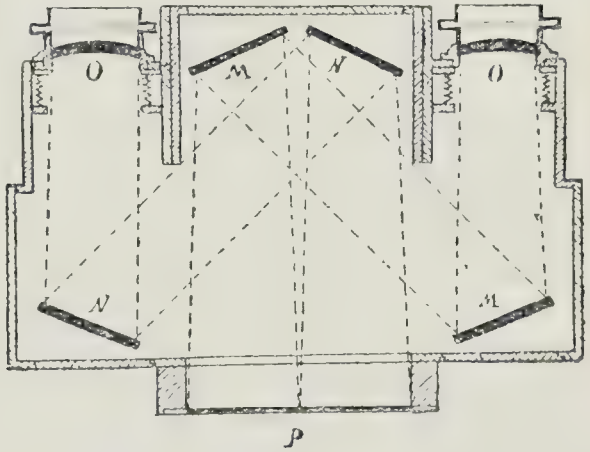
Fig. 2.

more than half the distance between the eyes, for the purpose of obtaining the desired stereoscopic effect. The two prisms 1 and 2 are arranged in a casing 3, which is dull black inside and which is provided at the back with a socket, 4, for the purpose of placing

it on the lens of a camera. The front and the back surfaces of the attachment are uncovered for the purpose of admitting rays of light to the lens. When using the stereo attachment, the camera is first sharply focussed. Any plate, film, and instantaneous camera of any size can be used, as long as it can be secured to a stand. The stereo-attachment is secured by its socket, 4, to the lens, so that the projecting part, *a*, points, say, to the left-hand side, see Fig. 2 full lines, and then a photograph is taken. Then the sensitive plate is changed and the attachment is turned through an angle of 180deg., in such manner that it projects to the right, Fig. 2, dotted. Then the second photograph is taken.—Eng. Pat., No. 21,909, 1905. "B.J.," Feb. 9, 1906, p. 111.

Transparencies by Artificial Light.—"J. R. E." describes his method of making transparencies from stereo negatives by using an ordinary lantern with a condenser large enough to cover one-half of the negative at a time, and making two exposures (moving both the negative and the positive plates after the first). The transparencies can easily be made almost equal to those printed by daylight, and with the additional advantage that an exposure can be exactly repeated at any time, as the light is constant. The only apparatus required is a sliding carrier for the negative, and a frame attached to the easel for the positive plate. He gives instructions for making the sliding carrier to hold the negative and the frame for the transparency plate.—"Phot.," April 3, 1906, p. 271.

Stereo Telephot.—M. Vincent describes an instrument which he has designed for stereoscopic work at long distances by means of which the inversion of the images is avoided. The apparatus is an adaptation of Vautier-Dufour and Schaer's telephot, which was described in THE BRITISH JOURNAL OF PHOTOGRAPHY, 1903, p. 589. The principle of the apparatus is as follows:—At O and O^1 are



the two lenses, at M, M^1, and N, N^1, are the plane mirrors. The rays transmitted by the lens O are reflected by the mirror M on to the mirror M^1, and thence on to the left-hand half of the plate P,

The rays from the left-hand lens O^1 are reflected by the mirrors N and N^1 to the right-hand side of the plate P. The separation between the two lenses was 29 cm. (= 11½ inches), and the focal length was 70 cm. (= 27½ inches). The images are in the correct position, and the prints are obtained without any inversion. By means of a pocket stereoscope the images on the ground glass can can be examined, and one can tell whether the relief is little or too great. The focussing of the two lenses is quite independent. When, in spite of the great differences between the various planes, one has to use a large aperture, one lens is focussed for a near point and the other for a distant plane, and when examined in the stereoscope the image appears perfectly sharp, and is superior to that obtained when both lenses are focussed on one middle-plane.—"Photo Revue," July 15, 1906, p. 20.

The Superposition of Stereoscopic Images.—A. Goderus dealt with this subject before the International Congress of Photography, but the paper cannot be usefully abstracted.—Report, Intern. Congress, 1905; "B.J.," Aug. 3, 1906, p. 606.

Rule for Mounting.—If two negatives are on one plate and are produced by lenses at a known distance apart, the rule for mounting the positives is: Add the separation between the two lenses (centre to centre) to the distance separating the eyes of the observer, and then deduct the distance between any two corresponding points on the two negatives. The result is the proper separation of the same two points in the positive prints.—"B.J.," Sept. 28, 1906, p. 761.

A Simple Method of Producing Stereo-photomicrographs.—W. P. Dollman describes his practice in adopting the method of using a semi-circular shield over half the lens.—("B.J.A.," 1904) "Journ. Roy. Micr. Soc.," June, 1906, p. 257.

H. Taverner, in the same journal recommends the use of a stop behind the objective when using the above method. By thus cutting out the axial rays a better stereoscopic effect is obtained.

STEREOSCOPIC PROJECTION.

The patent of W. H. Everson (No. 3,998, 1905) describes a system in which the stereoscopic effect on the screens is witnessed without observing the projected pictures alternately with the right and left eyes. The claim is for a stereoscopic lantern with a revolvable or travelling shutter or shutters so arranged and worked that the the stereoscopic pictures are alternately projected in periods separated by a distinct period of total obscuration of both pictures equal in duration to the duration of either period of exposure or projection. The invention is stated to differ from those where it has been proposed to project stereoscopic pictures superimposed upon a screen without the aid of a device to place before the eyes of an observer. In such an arrangement, the pictures have been projected in quick succession without the measured periods of the tentative total obscuration of both pictures, as is the case in the present invention.—"B.J.," March 30, 1906, p. 253.

PINHOLE PHOTOGRAPHY.

Pinhole Exposures.—D. J. Carnegie from photometric measurements made with a lens and pinhole under identical conditions finds

(1) That the correct pinhole exposure is, with the small pinholes used in practice, always greater than that calculated on a basis of relative aperture ratios.

(2) That the inverse square law cannot be applied in calculating relative exposures at varying plate distances from one and the same pinhole.

(3) That using a pinhole made by a number 12 needle, the pinhole exposure factor by which the A.R. exposure numbers (that is, the exposure which should be correct if the law of the inverse square of the aperture of the diaphragm held true) must be multiplied, varies from 1.6 to 1.42 as the plate distance diminishes from 254 mm. to 128 mm.—"B.J.," June 22, 1906, p. 484.

IV.—NEGATIVE PROCESSES.

Negative Processes.—In a comparison of the cost of sensitive materials for half-tone negatives it is shown that, per half-plate, the cost is 2¼d. for dry plates, 1¼d. for collodion emulsion, and 1d. for wet-plate, against which have to be placed differences in waste etc., incurred in these processes.—"B.J.," Feb. 16, 1906, p. 124.

The Gelatino-Bromide Process.

Backings.—A. Chevretot recommends the following backing for plates; it dries in ten minutes and can be readily removed with a damp sponge:—

White castile soap	1¼ ozs. ...	60 gms.
Alcohol 90 deg...	20 ozs. ...	1,000 ccs.
Dissolve in a water bath, and add		
Erythrosine	100 grs. ...	10 gms.
Aurine	80 grs. ...	8 gms.
Ivory black	80 grs. ...	8 gms.

"Phot. Revue," Jan. 14, 1906, p. 16.

EMULSIONS.

Pyridine in Emulsion Making.—Lüppo-Cramer has been trying the process patented in Germany about eighteen months ago by Dr. Witt, by which, so it was stated, extremely fine-grained and rapid emulsions could be obtained by using pyridine in place of ammonia for ripening; there being also greater freedom from fog. Although plates thus prepared were placed on the market some few months ago, the reports on the same were not very favourable, it being stated that the speed was low and the grain not abnormally finer than in plates prepared in the usual way. Dr. Lüppo-Cramer finds that pyridine

is practically useless, that no high speed can be obtained, and that emulsions prepared in precisely the same way, with and without pyridine, show but little difference in the size of the grain.—"B.J.," Dec. 8, 1905, p. 969.

Fine-Grained Emulsions.—M. Guilleminot, in speaking of some emulsions with very fine grain, which can now be obtained commercially, ascribes to them some properties which signalise them among the ordinary makes. With these plates it is possible to obtain clear and sharp images of objects of one-thousandth of an inch in length, about 1-250th of an inch being the limit with ordinary grained plates. The new plates also require much longer exposure to produce reversal, the actual increase being six times—that is, 150,000 times normal exposure. The gradation is also much better, and when orthochromatised the rendering of colours is much improved, and the results are such as have only been hitherto attainable with collodion emulsions.—"Bull. Soc. Fr. Phot.," Dec., 1905, p. 483.

Keeping Emulsions in Jelly Form.—Dr. Homolka summarises the various methods of keeping emulsions in jelly form, and states that far preferable to any is the use of pure benzole. The melted emulsion should be poured into a large stoppered bottle or vessel, and placed in ice so as to set it quickly, and stored so as to prevent the bromide settling out. When thoroughly hard, a thin film of pure benzole should be poured on the top of the emulsion and the vessel closed and placed in an ice chest. When required for use the benzole should be poured off, and the last traces allowed to spontaneously evaporate, and then the emulsion melted, as usual. Dr. Homolka states that he has kept even extremely rapid emulsions by this method.—"Eder's Jahrbuch," 1906, p. 15.

Silicic Acid Emulsions.—K. Schaum and E. Schloemann have examined an emulsion of silver bromide in an inorganic vehicle, colloidal silicic acid, and find that solarization takes place, and is increased by previous treatment of the plates with nitric acid. Experiments with the emulsion confirm Dr. Eder's view that the latent image consists partly of sub-bromide differing in its stability towards nitric acid and thiosulphate respectively.—"Zeit. für Wiss. Phot.," Aug., 1906; "B.J.," Aug. 31, 1906, p. 687.

Drying of Emulsion Films.—R. E. Liesegang calls attention to a peculiar action of gelatine, and incidentally of collodion. A mixture of equal parts of a 10 per cent. solution of gelatine and 10 per cent. solution of potassium bichromate was coated on glass and dried; after two days the salt had crystallised out on the film in the well-known tree-like form. The plate was then well washed, but the gelatine itself showed the tree-like markings. Other salts showed the same results. The crystals are not evenly distributed for the extreme margins, for about five milimetres' breadth showed no crystallisation, although the yellow colouration proved that they contained bichromate. This phenomenon appears with other preparations, such as silver chloride printing-out plates, and the author asks, "Why are the margins poorer in salts?" If the edges dry before the middle of the plates, does the water in the damp parts abstract the salts from the neighbouring drying parts, although the

damp parts may themselves be saturated with salts? Liesegang ascribes this to a peculiar action of the drying gelatine, that is to say, the salts are pressed out of these parts, and states that with collodion precisely the same action, which is not a pure diffusion process, takes place, for with all collodion papers gradually the whole of the soluble salts and acids are "pressed out" into the paper support. Liesegang states that if to a washed collodio-chloride emulsion some soluble chloride be added and coated on glass after a few days, the whole of the silver salts have "wandered" from the collodion film, which is perfectly clear and silver free, and that they are imprisoned between the glass and collodion. A collateral experiment with barium platino-cyanide suspended in collodion or celluloid varnish for making a radio-active screen, showed exactly the same phenomenon. That this is not due to the sinking of the heavy particles of the salt is proved by the fact that exactly the same thing occurs when the position is reversed, that is to say, when the collodion film, after setting, is placed face downwards.—"Phot. Woch.," Jan. 2, 1906, p. 4.

Plate Speeds, etc.—C. E. K. Mees, in a series of three papers on "the interpretation of sensitometric tests," gives the constants desirable for specifying the character of a plate, viz. :—

The Inertia dealing with the sensitiveness.
χ ,, ,, colour sensitiveness.
$\gamma\infty$,, ,, density giving power.
κ ,, ,, velocity of development.
t_{γ_1} ,, ,, speed of development.
(Note.—These last constants are not identical, as is explained later.)
O dealing with ... ... the latitude.

Three other measurements of importance should deal with the fog, the grain, and the accuracy of coating.

Inertia, measuring the insensitiveness of a plate, is determined by Hurter and Driffield's method, in which the standard candle was first used as the source of light, and afterwards the pentane standard. Mees prefers a screened acetylene light of spectral composition very nearly that of daylight, as given in PHOT. JOURNAL, November, 1904.

Since the smaller the inertia the faster the plate, inertias are usually expressed by dividing the inertia into some number and giving the result as the sensitiveness number.

Hurter and Driffield, for practical use in the actinograph, expressed the results of their tests by means of numbers obtained by dividing the inertia into 34, so that the actinograph number $= \frac{34}{\text{Inertia}}$ This is what should always be meant by the expression H. and D. No. This value, however, depends on the light source used, and the statement that a plate has an H. and D. No. A does not always imply an actual test. The number adopted by Mr. Watkins for his P. number is obtained by him by doubling the H. and D. number he finds. But Mr. Watkins usually gets rather lower H. and D. numbers than Mees, and a better agreement with his P number is obtained by dividing the inertia into 50.

The F values given by Mr. Wynne appear to be the square root of the Watkins number multiplied by 8. (See "B.J.A.," 1906, p. 713.—Ed.)

γ_∞, the maximum range of gradation possible with a plate, so far as we know at present, depends on the plate, and on the plate alone. γ_∞ is the density-giving power of a plate, and governs what has been termed the "character" of a plate—i.e., low γ_∞ makes a soft plate, high γ_∞ a plate capable of strong contrasts.

A plate that can be "forced" in development when under-exposed will have a high γ_∞.

The rate at which a plate develops during the earlier part of its γ, t, curve is proportional to $\kappa \chi \gamma^\infty$.

Now, γ_∞ depends on the plate, but κ (velocity of development) depends also on the developer, on the developing temperature, and so on.

With the same plate, if we double κ, we halve the time necessary to get the same γ. We can increase κ to almost any extent by increasing the concentration of the developer, so that in making sensitometric measurements of κ we must carefully define the developer and temperature used. Since the chemical reactions of the ferrous oxalate developer are better understood than those of any other developer, ferrous oxalate makes a good standard, and a convenient standard is a developer containing 56 grammes of iron per litre at a temperature of 20 deg. C.

We see that for ease of development it is desirable to obtain a high κ, but it is much more important to obtain a high γ_∞.

In fact, of all the constants of a plate, Mees considers γ_∞ the most important. For example, if a plate is being used for extremely under-exposed focal-plane work, then a high γ_∞ is far more valuable than a high speed.

For instance, the following two plates gave practically identical results, by eye judgment, at F.3.5, 1-500th sec.

Plate.	Inertia.	H and D No.	γ_∞
.....	.260	 131	..... 1.88
2	1.190	..... 28.6	..... 4.01

It is for this reason that slow plates can frequently be used for extremely short exposures, because the high γ_∞ often associated with a slow plate compensates for the low sensitiveness.

Values of γ_∞ may range from 1.5 (low) to 3.5 (high), or even above or below these limits. κ from .03 (low) to .2 (high).

As a general rule, κ is higher in a slow plate than in a fast, and it almost always decreases if the plate is kept.

The constant $t\gamma_1$ is the time necessary to reach a γ of 1 and is easily calculated from the values of γ_∞ and κ. It is of use in comparing the rates of development of two plates which have widely different γ_∞'s.

The constant 0 is the measure of the optical opacity of the unexposed plate to blue violet light (W. length 4,300). It is of importance, because in order to measure it, plates are exposed as for speed testing, but with first a 4 per cent. solution of potassium chromate, and, secondly, a 2 per cent. solution of copper ammonium sulphate, in

a 1 cm. thick cell between the light source and the plate; the light source being, as before, acetylene screened, to give the spectral compositon of daylight. The resulting inertias are then measured and the ratio:—

$$\frac{\text{Yellow Inertia}}{\text{Blue Inertia}} = \frac{\text{Blue Sensitiveness}}{\text{Yellow Sensitiveness}} = \chi.$$

χ may vary in commercial plates from 20 for rather poor erythrosin plates to 5 for panchromatic plates, or 2 for plates with subdued blue sensitiveness, while for bathed plates it may become 1 or slightly less. The lower χ, the better the colour-sensitiveness. The other three measurements which should be made for a plate to be tested deal with the fog—*i.e.*, the velocity of blackening without exposure, the grain, and the evenness.

The last of these is easy to measure, but scarcely worth the labour involved. Owing to the extreme variability of fog, and the sensitiveness which it displays towards external influences, it has not been found possible to measure the extent of the fog due to the plate itself with any regularity. All that can be done, in fact, is to make general statements by eye comparison.

The following specifications for plates for different purposes may be taken as those which Mees personally would choose, and which the platemakers, in the present state of knowledge and technical skill, may be reasonably expected to supply.

All plates should be quite free from perceptible fog, be evenly coated, and have a reasonably fine grain.

For a portrait plate (colour-sensitive):—

i	=	.125
χ	=	8
γ_∞	=	2.2
κ	=	.080
0	=	20

For a landscape plate (colour-sensitive, slow):—

i	=	.500
χ	=	3
γ_∞	=	2.5
κ	=	.130
0	=	20

For a hand-camera plate for forcing in development, some result being more important than truthful gradation:—

i	=	.150
γ_∞	=	4.0
κ	=	.060
0	=	20

For a process plate for line work:—

i	=	3.0
γ_∞	=	4.0
κ	=	.170
0	=	7

For three-colour and orthochromatic work the corresponding plate bathed in an isocyanine dye. If sensitised in the emulsion $\chi = 5$.

For a transparency plate:—

$$= 5.0$$
$$\gamma_\infty = 1.8$$
$$\kappa = .300$$
$$= 10$$

Individual workers will probably agree that some of these specifications may be altered to agree with personal references.—"B.J.," Feb. 9, p. 104; Feb. 16, p. 126; Feb. 23, p. 143, 1906.

S. E. Sheppard and C. E. K. Mees, in a paper on "The Chemical Dynamics of Development, Including the Microscopy of the Image," find that with ferrous oxalate developer and gelatine plates:—

(a) With constant development for a short time, the depth of the image is independent of the exposure.

(b) With increased time of development, the depth rapidly increases and reaches a maximum for each exposure, after which it is constant.

(c) With long development, the depth gradually increases with the exposure.

In regard to the grain of the plate, the authors find that over a long range of exposure, for infinite development, the size of the grain is independent of the exposure; that the size increases gradually with the time of development; that bromide with developer lowers the size of the grain (more so, the less the exposure); that on infinite development the grain attains the same size in a bromided as in a non-bromided developer; for moderately long development the number of grains in surface area is independent of exposure; that during development the number of grains increases very rapidly at first, then more gradually till a maximum is reached. From exposures made through the glass, the authors conclude that the grains receiving the most exposure start development first.

The authors criticise the "time of appearance" rule of Watkins, holding that the simple relation does not apply to many complex developing solutions. The authors find that treatment of a plate with 4 per cent. formalin, whereby the gelatine becomes insoluble in boiling water, does *not* lower the velocity of development.—"Phot. Journ.," Oct., 1905, p. 319.

The Microscopic Examination of Emulsion Films.—Neuhauss has examined exposed films microscopically by ultra-violet light to see whether it was possible to detect grains of metallic silver in the same. There are extreme difficulties in the way of examining the unfixed films, for the reason that the more intense the light the greater the resolving power, and even ruby light of the necessary intensity is not without action on the silver salt. Also, the resolvent power, even of the best micro-objectives is not sufficient for detecting the extremely minute change in the bromide of silver molecule. There might be a possibility of detecting some change in plates which had been exposed and fixed. Such plates can, as is well known, be developed with a developer containing silver *in statu nascendi*, and there is therefore something which remains from the primary image. As the

source of light, sunlight was used. The gelatine to be examined was placed in a small trough, which only held a few drops. The results were: (1) that pure emulsion gelatine, filtered through leather, shows a very large number of bright shining particles, of different sizes, close on the limits of visibility, and without decided colour; (2) the gelatine melted from an unexposed and fixed plate showed the same appearance; (3) a drop or two of gelatine melted off a plate, which had been exposed for a short time in the camera and then fixed and washed, showed precisely the same appearance as in 1 and 2; (4) a plate exposed as in No. 3 was fixed and washed, and then physically developed till just the first traces of an image were visible. A drop of melted gelatine from this plate showed innumerable brilliant yellowish specks of about the same size (metallic silver); (5) a plate was exposed without a camera for ten minutes in a room to diffused daylight. It was then fixed and washed, and showed the same appearances as in Nos. 1, 2, and 3; (6) a plate was exposed for ten minutes to direct sunlight, then fixed and well washed. The film, which had turned bluish-green, looked after fixing greyish, and in the ultramicroscope showed innumerable very bright yellowish or yellowish-red specks of practically the same size; (7) a plate was exposed for an hour in the sun, then fixed and washed. On examination, which was extremely difficult on account of the dark colour, the film was seen to be crowded with flocculent masses of the particles of the same colour as in No. 6. The experiments gave no satisfactory proof of the existence of the particles in the gelatine, caused by exposures within ordinary limits. Were it possible to replace the gelatine by an optically homgeneous substance, it might be possible to count the difference in number of particles in an unexposed and an exposed plate. Apparently there is no separation of metallic silver by ordinary exposures. It was only when the exposure was so prolonged that the film visibly darkened that the existence of any particles could be seen; and then these could be detected with an ordinary microscope.—"Phot. Rund.," Nov., 1905, p. 308; "B.J.," Dec. 8, 1905, p. 969.

Theory of Fixation.—S. E. Sheppard and C. E. K. Mees, in a paper on "The Theory of Fixation and the Action of Thiosulphate in Development," describe experiments in which they had measured the densities of small portions of plates in course of fixation in very weak thiosulphate solution. The piece of plate was placed in the Schultz cell of the spectro-photometer, the volume of solution thus used being 2 cc.s., equivalent to .006 of a gramme of thiosulphate for the lowest concentration. To avoid errors from scattered light the observations were made by diffused light from a screen of opal glass, and a filter of yellow gelatoid was also employed to prevent darkening of the plate during or after fixation. Experiments made in this way showed that the addition of potass bromide up to N/10 strength did affect the rate of fixation, which was found to be directly proportional to the concentration of the thiosulphate. Ordinary plates were found to fix more quickly than rapid ones, probably owing to their greater fineness of grain and lesser content of iodide. In regard to the theory of the process the authors concluded that the efficiency of the fixing agent depends upon the stability of the compound, or complexion, formed with the silver halides. The course of fixation

appeared to be governed by the rapidity of the penetration of the fixing solution into the gelatine film; the chemical action was probably very fast compared with this latter process. The velocity of fixation was found to increase up to a certain point and then remain constant.

In examining the fixation of films tanned with formaline the authors found no difference in the velocity of fixation between the tanned and untanned films, nor was it possible to distinguish any difference between exposed and unexposed plates in this respect. Stirring was found to accelerate fixation, and also to modify the course of the reaction.

The authors' general conclusions were that in fixing three processes are concerned. Firstly, the diffusion into the film, as a whole, of the fixing solution. Secondly, diffusion through the grain of the plate; and, lastly, the chemical action of the fixer.

In studying the action of solvents of silver halides in developers they examined development with ferrous oxalate and with alkaline developers, containing in both cases small quantities of thiosulphate. They ascribe the well-known alleged accelerating action of hypo in the iron developer to the formation of a germ image of silver sulphide from the action of the acid developer on the thiosulphate. In the case of alkaline developers, the effect of the hypo is to retard development, similarly to bromide, but much more irregularly.—"Phot. Journ.," June, 1906, p. 235.

Marginal Fog.—Dr. Stolze states that marginal fog on plates is due to radiations from the packing materials. Incidentally, he points out that ammonia emulsions are much more liable to this than acid boiled emulsions, and this is due to traces of ammonia being tenaciously held by the gelatine. To render this harmless he suggests that carbonic acid should be pumped through the emulsion or carbonic acid water be added to the same, so as to form the true ammonium carbonate. If the plates are already coated, then it is sufficient to fume the plates with carbonic acid [He does not state whether the plates are to be wet or dry.—Ed. "B.J.A."], and advises that plates intended for the tropics should be packed in boxes filled with carbonic acid instead of air. Plates kept in metal boxes at fairly high temperatures for varying periods of time showed marginal fog, and more at the edges of the glass than those edges which were cut from a larger plate. From this curious fact he argues that the effect is due to "rays."—"Atelier," Heft. 4, 1906, p. 38; "B.J.," April 20, 1906, p. 310.

Dr. Homolka suggests lithium bromide as the best preventive of marginal fog in gelatine emulsions.—"Phot. Korr.," May, 1906, p. 216.

Dr. Homolka has made experiments indicating that the diffusion of the bromide from the edges of the emulsion is the cause of marginal fog.—"Phot. Korr.," Dec., 1905, p. 550; "B.J.," Dec. 22, 1905, p. 1008.

Orthochromatic Processes.

Relation Between Visual and Chemical Absorption.—Drs. Precht and Stenger have spectroscopically examined the maximum absorptions and sensitising of ethyl-red, pinachrome, homocol, orthochrome,

and pericol, and prove that the two do not correspond, but that the sensitising maximum was shifted towards the red by about 20 wave lengths. Tables in proof of the statement are given. Thus it is proved that these new dyes obey the same laws as those of the earlier known sensitisers.—"Zeit. für Repro.," Nov., 1905; "B.J.," Dec. 8, 1905, p. 969.

"Colour-Correct Photography," by T. Thorne Baker (London: Dawbarn and Ward), has been published in the past year, and forms an instructive guide to orthochromatic photography.

SENSITISERS.

Pinacyanol.—Valenta supports Hübl's method of using pinachrome, and speaks very highly in its favour. He also advises a similar bath of pinacyanol for dry plates. When used with collodion emulsion, to 4-5 per cent. of 1-1,000 alcoholic solution of pinacyanol, it gives very good red sensitiveness. Referring to Newton's statement (B.J., 1905, p. 830), that pinacyanol gave a "much faster" emulsion than ethyl violet, Valenta states that he cannot confirm this. Pinacyanol sensitises further into the red than ethyl violet, but the latter when correctly used gives a more vigorous and brilliant action in the red, and gives cleaner plates than the former. This is of the greatest importance in half-tone work.—"Phot. Korr.," March, 1906, p. 132.

Mixed Sensitisers.—M. Menpillard has been spectroscopically testing the sensitising action of a mixture of pinacyanol, or dicyanine and homocol, and finds that with both much more even sensitiveness is obtained throughout the spectrum. The bath used was:—

Pinacyanol or dicyanine (1 : 1000 alcohol) ...	5 ccs.
Homocol (1 : 1000 alcohol)	5 ccs.
Liq. ammonia	0.1 ccs.
Distilled water	1,000 ccs.

The developer used was the acid amidol developer, containing 0.25 per cent. of bromide. With dicyanine the sensitiveness extends to 750, with pinacyanol to 680. It is stated that all the colours are equally active, and that over-exposure was easily obtained with an orange screen.—"Procédé," Feb., 1906, p. 20; "B.J.," March 30, 1906, p. 245.

Red Sensitisers.—Meister Lucius and Brüning have patented a series of dyes as red-sensitisers for gelatine emulsions. The dyes are colouring matters of the quinoline group, produced by the action of an alkali, in presence of formaldehyde (or of a substance yielding formaldehyde) on a salt of an alkyl-quinaldinium base, either alone, or mixed with a salt of an alkyl-quinolinium base.—Eng. Pat., No. 16,227, 1905; "B.J.," April 13, 1906, p. 293.

Alizarine Blue.—Walter S. A. Scoble, in a paper on "The Red Sensitiveness of Dyed Films," states that he was successful with alizarine blue, used as follows:—The dye was kept in 1 : 500 solution containing 1 per cent. of ammonia, and this was diluted for use (with water containing 1 per cent. of ammonia), to give 1 part of dye in 10,000 parts. The films were washed for about three minutes in a 1 per cent. solution of ammonia, and then kept in the sensitising

bath for three minutes. Finally they were washed and exposed wet It was afterwards found better to dissolve 1 part of the dye in 500 parts alcohol, with ten parts ammonia, and then add 500 of water. This is filtered and used soon after it is prepared, as the colour slowly changes to blue, the alteration being easily detected after about two hours. The preliminary bath is not an absolute necessity, but it prepares the film for the reception of the dye.—"Phot Journ.," May, 1906, p. 190.

Red-Sensitive Plates.—Von Hübl reviews the older methods of sensitising for red, and points out that ethyl-violet was a distinct advance, and is interesting because of its great stability to light. Its decided action proves that the fugitiveness of the dye plays no part, but that the dye and silver compound is the factor.

The new isocyanines are formed from chinaldine, lepidine, chinoline, etc. They are all fugitive dyes, the solutions of which are decolourised by acids, and all of them are sensitisers. In conformity with the general rule, these dyes sensitise for those colours, to which they—or, rather, that colour, which they impart to silver bromide—are complementary. That is to say, a purple red, violet, or blue cyanine will sensitise for green, yellowish-green, or green respectively. This does not imply that the sensitiveness is confined to these particular regions; each extends to the neighbouring colours in differing intensities and extent. Thus, a purple-red cyanine sensitises not only for the green, but also for yellow-green and blue-green, perhaps also for yellow and orange, for these can—a certain intensity assumed—in the sum be called green, and thus be the complementary to purple.

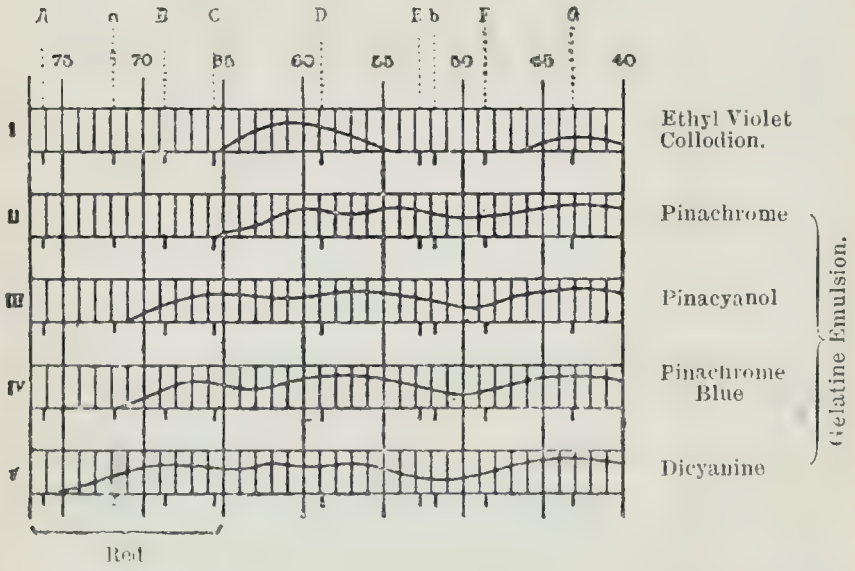
There is a close connection between the spectrum sensitising band and the absorption of the dye, and from the latter one may deduce the extent and the intensity of the assumed colour-sensitiveness. The extension of the band of sensitiveness is of the greatest importance, for it shows what colours will act on the plate. These broad sensitising bands are the great value of the cyanines.

So far, dyes have not been discovered which will sensitise for the whole stretch from blue to red, and we must choose between those which sensitise from the blue-green to the yellow-orange, or those from green to red-orange; to the first class belong ethyl red and pinaverdol, which require a long exposure behind the red filter; whilst the latter include pinachrome, which does not act so well behind the green filter. These dyes do not sensitise for the extreme red, and therefore the plates may be worked in a deep red light.

The newer cyanine, pinacyanol, discovered by Dr. König, sensitises very strongly for red, and is the first actual red sensitiser, and may even be used with collodion emulsion. It has a maximum between B and C, and reaches to E b.

The accompanying chart, which is the result of the experiments of von Hübl's assistant, Herr G. Winter, puts in a nutshell the sensitising power of these dyes. The results were obtained with a Thorpe diffraction grating spectrum and a Nernst lamp. I. shows the sensitising power of the ethyl-violet; it is comparatively narrow, and includes only the yellow and orange. II. shows the effect of

pinachrome, a much broader band, and yet it is not a true red sensitiser. III. shows the effect of pinacyanol, and we have here a true red sensitiser, whose action extends to a. The effect of another cyanine, called pinachrome blue, is shown in IV., and it behaves very much like III. Dicyanine which far surpasses these last two in red sensitising, has been described (see ALMANAC, 1906, p. 771), but the results obtained were unreliable, because the dye was not pure. As will be seen from V., the pure dye sensitises from almost A to E b, with three maxima at B, C½D, and behind D. Naturally, this permits of much shorter exposures behind the red filter than all other dyes.



All these dyes can be used for gelatine and collodion, and have no tendency to fog, only a perfectly safe dark room light must be used. As all red glasses transmit rays from B½C, clean negatives cannot be obtained, and it is advisable to use a blue-green light, which may be obtained by using gelatined glasses, one soaked in naphthol green and the other in methyl-violet. Naphthol green is the only green dye that can be used, as other greens, such as acid or fast green, let through a band in the red. The naphthol green solution should be acidified with a few drops of glacial acetic acid, and the methyl-violet be rendered alkaline with a little borax. With properly stained films, the light transmitted by the two in combination is about the F line.

For collodion emulsion 1 per cent. of a 1 : 1000 solution of the dye should be used, and after the plate has set it should be bathed in water or rinsed under a rose tap. This washing considerably increases the sensitiveness. The unwashed plates work clean, but are less red sensitive. Even when added in much larger quantities the dyes do not cause fog, but the dyed emulsion soon loses its red sensitive-

ness, which, however, can again be renewed by the addition of more dye. This phenomenon has been observed with all cyanines, but whereas with pinaverdol the red sensitiveness disappears after some weeks, with the new cyanines it disappears from one to two hours. The emulsion does not lose its blue colour, and this appears to be independent of the quantity of dye added.

These dyes are excellent sensitisers for gelatine plates, and the dye-bath should be:—

Water	120 parts.
Alcohol	60 parts.
Dye solution 1 : 1000	1 part.

and the plate should be left in for at least ten minutes,* and the plates should be dried as quickly as possible. This last point is very important, otherwise vigorous clean negatives cannot be obtained.

It is absolutely necessary that this semi-alcoholic bath be used, as nothing like the same high colour sensitiveness can be obtained by the use of an aqueous solution. This is strikingly shown in the case of pinachrome blue. The reason is that with water these dyes do not form solutions which will penetrate the gelatine. If an aqueous solution of these dyes be repeatedly poured through a paper filter, the whole of the dye will adhere to the paper and the filtrate be almost colourless. In contact with gelatine the aqueous solution behaves in the same way, and the bulk of the dye is deposited on the surface of the gelatine and causes fog, spots, and streaks there, whilst practically no dye penetrates the film.

The three dyes do not behave quite the same with collodion and gelatine. With the former the sensitiveness is greater in the red than in the yellow and green; whilst with gelatine the reverse is the case. This is due to the absorption of the dyes in aqueous and alcoholic solution. (See ALMANAC, loc. cit.—ED.) The intensities differ, too. With gelatine plates pinacyanol is most vigorous; with collodion, on the other hand, dicyanine is the strongest.

If a colour chart is taken with the dyed collodion emulsion, without a filter, in the case of pinacyanol and pinachrome blue, vermilion is rendered as light as ultramarine; with dicyanine the former is the lighter. The exposure is only about half or quarter of that with the undyed emulsion. The total sensitiveness of the plate is therefore about quadrupled.

In making the blue print negative only a bright orange filter is required, and the exposure increased only by about a half. The red sensitiveness of the plates is greater than the blue sensitiveness, so that these dyes are of the utmost importance for three-colour work with collodion emulsion.

The results with gelatine plates are less satisfactory, but even with these without a filter, vermilion is fully exposed and chrome yellow is as dense as ultramarine. Pinacyanol acts well, and, as already mentioned, gives absolutely clean, vigorous negatives. It might be possible that these dyes are preferable to pinachrome and ethyl-red as panchromatisers; in any case, they permit of a considerable reduc-

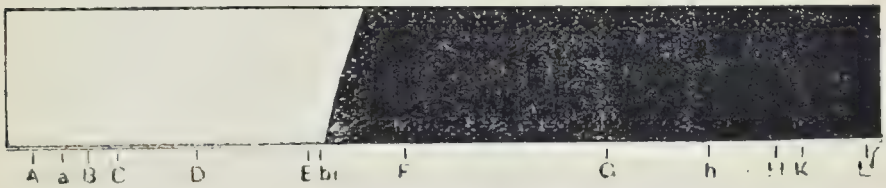
* Dr. König informs us that he has determined by very careful tests that 3—4 minutes bathing is quite sufficient.—ED.

tion of the exposure behind the red filter, and the minimum between *b* and F ought not to appreciably degrade the red print plate.—"Atelier," Jan.-Feb., 1906, pp. 6, 14.

LIGHT-FILTERS.

"*Luminosity*" *Filter.*—C. E. K. Mees, in a paper before the Croydon Camera Club, explained the method of preparing a "luminosity" filter for a given plate—i.e., a filter for giving correct luminosities in the monochrome reproduction of coloured objects. The colour-sensitiveness curve of the plate (the Wratten Panchromatic) was first measured. Together with the spectrum plate there was developed a plate which had been exposed behind the sector wheel, thus giving a connection between the density obtained and the light incident. By interpolating the densities of the spectrum record upon this curve we may obtain a record of the equivalent intensities incident. Thus at 6,300 the spectrum record gave a density of .444. From the sector wheel exposure .244 corresponded to an exposure of .632 candle metre seconds, and .584 to an exposure of 1.264 candle metre seconds, consequently a density of .444 corresponds to an exposure of 1.02 candle metre seconds, which is recorded for 6,300. The blue part of this plate curve of the Wratten panchromatic was first measured and is shown by dividing the height of the solid line by the height of the dotted line. This process gives the screen required. The screens are made by adjustments of the dyes in the spectrophotometer to fit the curve, and then are prepared as gelatine filters.—"B.J.," June 1, 1906, p. 430.

Filter Yellow K.—Dr. Novak calls attention to the new "Filter Yellow K," of Meister Lucius and Brüning. The special feature of this new dye is that is absorbs the whole of the ultra-violet, a feature which is possessed by very few of the yellow dyes now used



for making colour screens. The accompanying diagram is from a negative taken in a large quartz spectrograph of the K. K. Lehr und Versuchanstalt, at Vienna, and it will be seen that the absorption extends from L in the ultra-violet to $b\frac{1}{2}$ F.—"Phot. Korr.," Aug., 1906, p. 384.

Dr Novak states that the following screen will give almost a perfect colour rendering:—Filter yellow K, 1 gm.; water, 20 ccs. To 100 ccs. of a 6 per cent. solution of gelatine add 20 ccs. of above solution, and coat 7 ccs. of the dyed gelatine on 100 sq. cm. of glass. —"Eder's Jahrbuch," 1906, p. 159.

C. E. K. Mees and S. H. Wratten find that the new "Filter Yellow K" of Meister Lucius and Brüning cuts out the whole of

the ultra-violet while having the gradual absorption of tartrazine. In other respects the dye is suitable for ortho screens, being easily soluble in water and mixing well with gelatine.—"B.J.," Sept 28, 1906, p. 765.

TESTING ORTHO PLATES.

C. E. K. Mees and S. E. Sheppard, in a lengthy paper on "The estimation of the colour sensitiveness of plates," review existing methods, and then lay stress on the need (for test purposes) of an artificial light of the spectral composition of daylight. They use acetylene filtered through a double screen of

A.	Gentian violet	2·0 parts	1 cm. thick.
	Acid green	1·0 ,,	
	Mandarin orange	1·0 ,,	
	Rose Bengal	·4 ,,	
	Water	100,000 ,,	

B. Copper acetate solution, $1\frac{1}{2}$ % 1 cm. thick.

In the case of orthochromatic plates the ratio of blue sensitiveness to yellow sensitiveness is sufficient test, but panchromatic plates, as used for three-colour work, require the measurement of red sensitiveness, which is also necessary in the cases of plates of red sensitiveness, or in tests of dye sensitisers. In place of Eder's yellow or blue filters (yellow, 4 per cent. sol. potassium chromate, 1 cm. thick: blue, 2 per cent. copper sulphate sol., saturated with ammonia: 1 cm. thick) they use Eder's screen to pass the blue only, a combination of Eder's yellow screen and a saturated solution of copper acetate to cut out the red (green screen), and for the red screen a gelatine film of rose Bengal and tartrazin, suggested by A. J. Newton. Measurements were made of the $\frac{\text{blue-sensitiveness}}{\text{yellow-sensitiveness}}$ (see "B.J.," 1906, p. 88), and of the $\frac{\text{red-sensitiveness}}{\text{blue-sensitiveness}}$ with these screens, allowance being made by measurements for the ultra-violet light in daylight.

In the case of experiments on the various isocyanine dyes to discover the best means of sensitising with them, it was found that:—(1) Washing for ten minutes produced a maximum effect; (2) that provided the plate is bathed long enough the time of bathing is of no importance—three minutes long enough; (3) that a 1 in 50,000 solution gave the best results. The dye used was pinacyanol, giving great sensitiveness to the extreme red, and allowing all the lines of the solar spectrum from the ultra-violet to B to be photographed at one exposure. Dicyanine was found to sensitise up to 7,600 from 5,900, but with small sensitiveness, and the dye is thought to be useful only for spectro-photography of the infra-red.—"Phot. Journ.," March, 1906, p. 110.

A. J. Newton and A. J. Bull give the graphic results of tests of commercial ortho plates and sensitisers in the shape of spectrum photographs. By sensitising collodion emulsion they obtained results as follows:—

Bayer's Isocol confers a fairly even sensitiveness from 5,000 to 6,400, with maximum at 5,800.

Albert's S dye confers a sensitiveness from 5,400 to 6,900, very even throughout this, but with slight maximum at 6,500. Blue sensitiveness entirely suppressed.

Pinacyanol.—The sensitiveness is the same as the last, except that the blue sensitiveness is not entirely suppressed. This would seem to be the best sensitiser for red so far available, and although not sensitising for the extreme red in the same manner, it is much easier to work and superior in speed.

Dicyanine.—The peculiarity of this dye is that it sensitises to the extreme red light, the sensitive region extending from 5,600 to 7.200, the maximum effect being about 6,900.—"Phot. Journ.," July, 1906, p. 279.

Tests of Plates for Astronomical Work.—R. J. Wallace prefers to take spectrum photographs with the "Wallace" diffraction grating replica, giving consecutive exposures of 2, 5, 15, and 30 seconds, 1, 2, 4, 8, and 16 minutes. To then plot the sensitiveness-curve, a print was first made on Solio paper from one of the plates and that exposure selected which represented the highest allowable printing opacity—that is to say, that spectrum which was so opaque in the region of greatest sensitiveness that it was only with difficulty that the Fraunhofer lines would show on the print. This opacity was found to be represented by a light action of 256 units on a negative obtained from exposure behind a revolving Hurter and Driffield sector-disc, on the same plate, developed for the same length of time. On every other plate, therefore, the spectrum was selected for estimation whose greatest region of opacity corresponded to 256 light units on a similar plate exposed by disc. The curve was then plotted on squared paper, where the ordinates represent amount of light action (in units), and the abscissæ, wavelengths; the variations in opacity throughout the length of the spectrum being estimated by small patches isolated by an opaque screen and in juxtaposition with the various opacities of the sector negative, the aperture ratio of which is accurately known. These curves are representative only of "selective sensitiveness," no consideration whatever being given to the relative speeds. Tests were made from the standpoint of the "Schwellenwerth" as being best suited to astronomical needs, where the principal point is to obtain developable action with the smallest light value. These tests for the plates plotted may be tabulated in the following results:—

Cramer "Instantaneous Isochromatic"...	= 1
Seed "Landscape Orthochromatic"	= 3 per cent. less.
Lumière "Ortho C" }	= 7 per cent. less.
Lumière "Ortho A" }	
Lumière "Ortho B".....	= 14 per cent. less.
Cramer "Trichromatic"	= 40 per cent. less.

—"B.J.," Oct. 27, 1905, p. 845.

The author checks the opacity estimation of these curves:—A density-curve was selected (Cramer "Instantaneous Isochromatic") which had been plotted from the opacity-curve already published, and which should be, theoretically, exactly the inverse of the original.

This was mounted upon a sheet of opaque paper and its area carefully cut out, then placed in a camera, and an image projected of a size comparable with the original negative. This last adjustment was readily effected by making pinholes through the paper mask at the positions of the Fraunhofer lines (abscissæ) and focussing the bright images to size. By means of a plate swinging vertically the image of the curve was caused to impress itself with varying density, the pinholes being distinctly shown as slightly darker lines crossing the negative of the artificial spectrum thus obtained.

This negative was found to be closely comparable with the original spectrum negative, when due allowance was made for the effect of the Fraunhofer lines in the latter.—From the "Astro-Physical Journal"; "B.J.," Jan. 19, 1906, p. 50.

Spectro-Sensitometry.—Ed. Belin describes with figures and diagrams a method of spectro-sensitometry by means of a spectrograph fitted with a transmission diffraction grating, and in front of the slit a shutter with a sinusoidal movement. After exposure a scale is impressed on the plate, which enables one to read the characteristic curve direct as regards the sensitometric numbers, and the Fraunhofer lines.—Report, Intern. Congress, 1905; "B.J.," Aug. 10, 1906, p. 630.

Developers and Development.

DEVELOPERS.

Acid and Alkaline Amidol Developer.—MM. Lumière and Seyewetz have investigated the developing power of acid and alkaline amidol developer, and they come to the following conclusions: 1. Diamidophenol hydrochlorate in aqueous solution acquires a notable developing power, when sufficient sodium sulphite is added to saturate the hydrochloric acid which it contains, and this in spite of the sulphurous acid is set free. 2. The reducing power of the developer is considerably increased if the free sulphurous acid is exactly converted into bisulphite. 3. That the reducing power is still further increased if this free acid is converted into neutral sulphite. 4. The addition of increasing quantities of sulphite, even up to saturation point, does not increase the action which is constant for 5 parts amidol, 30 parts sulphite, and 1,000 parts water. With 120 parts of sulphite the developing power decreases. 5. The greater part of the sulphite in a normal developer may be replaced by alkalies. 6. The developing power of a normal developer may be considerably augmented by the addition of alkalies. Ammonia, acetone, and lithium carbonate appear to give the best results. 7. The greater or less acidity of the developer bears no relation to the developing power of the developer. Assuming that a normal developer is amidol 5, sulphite 30,

water 1,000, the following table gives the quantity of alkalies which may be added to increase the action:—

Caustic potash	2.8
Caustic soda	2
Caustic lithia	1.3
Ammonia	0.7
Potassium carbonate	8
Sodium carbonate	6
Lithium carbonate	6
Tribasic phosphate of soda	20
Acetone	20
Aldehyde	5
Trioxymethylene	1

"Bull. Soc. Fr. Phot.," Feb. 1, 1906, p. 76.

Metol Skin Affection.—Dr. J. M. Lazenby includes, among the causes predisposing to metol skin affection (*i.e.*, causes which tend to lessen the natural oil in the skin and so permit the penetration of the metol):—(1) Prolonged soaking in the developer; (2) the excessive use of alkaline or mercurial solutions; (3) the use of hard water and alkaline soaps; (4) the thinning and drying of the skin which occurs after middle life; (5) the abuse of stimulants, which dilate the blood vessels of the skin and irritate the nerve-endings. When using metol, the fingers must be protected with finger-stalls of rubber, and the whole hand frequently rinsed under the tap during the operation of developing. Should the characteristic itching indicate that an attack has commenced, the hand should be soaked in warm water for five minutes, carefully dried with a soft towel, and then well rubbed with lanoline, or any other ointment of a non-irritating character. Dry skin should not be scratched or peeled off, but be removed with pumice stone. Any kiens which may appear from cracking of the dry skin should be painted with collodion, taking care to get the paint well down into the sore. And, lastly, after a first attack, the use of metol could be discontinued entirely.—"A. P.," June 5, 1906, p. 480.

New Developers.—The Actien Gesellschaft für Anilin-fabrikation, Berlin, has patented a photographic developer from para-oxy-phenylglycinamide. $HO.C_6H_4.NH.CH_2.CO.NH_2$. ($HO:NH.CH_2.CO.NH_2 = 1:4$), for which purpose this compound is well fitted by its energetic action, and by the fact that it yields clear and clean images. It works with alkaline carbonate, though caustic alkali can be used. Alkaline solutions of the new developer can be kept for a long time without loss of developing energy. The following is an example of the method of making up the developer:—(1) With potassium carbonate and sodium sulphite: One part of para-oxy-phenylglycinamide is dissolved in 200 parts of water with the addition of five parts of dry potassium carbonate and five parts of anhydrous sodium sulphite. (2) Or for a concentrated developer: One part of para-oxy-phenylglycinamide is dissolved in ten parts of water, and this solution mixed with a solution prepared by dissolving 3—4 parts of anhydrous sodium sulphite, together with 3—4 parts of dry potassium carbonate in twenty parts of water. In using such a concentrated developer for developing, ten parts are to be diluted with

50—60 parts of water.—Eng. Pat., No. 9,537, 1905; "B.J.," March 2, 1906, p. 174.

Pyro-Soda and Sulphite. — Sulphite of soda in solution, with carbonate of soda or other alkali, rapidly deteriorates and causes the loss of developing properties to a pyro-soda developer and stain in the negative. This fact, pointed out in "B.J.," June 15, 1906, is disputed by H. W. Bennett, who finds such a mixed solution to keep well, though the use of "washing soda" will lead to staining and inferior quality of negatives. Sulphate in the developer will give rise to staining.—"B.J.," Sept. 28, 1906, p. 766.

Some editorial notes in the same issue point out that the effects produced when sulphite oxidises are not explained by conversion of sulphite into sulphate which appears to be inert in the developer. The best keeping properties of a two-solution pyro-developer are found to result from the use of soda sulphite, kept in the pyro solution and neutralised with potass metabisulphite, and carbonate of soda in plain solution. The formula for such a developer is:—

A.—Soda sulphite	2	ozs.
Potass. metabisulphite	½	oz.
Pyro or pyraxe	160	grs.
Water, to	20	ozs.
B.—Soda carbonate	4	ozs.
Water, to	20	ozs.

Use equal parts of each.

It is most convenient to keep a stock of the neutralised sulphite solution on hand, dissolving, say, 4 ozs. of sulphite and 1 oz. of metabisulphite in 40 ozs. of water. With 10 ozs. of this solution the pyro solution (A) can be made up at short notice.—"B.J.," Sept. 28, 1906, p. 762.

W. Weissenberger (St. Petersburg) records a series of experiments with mannite, glycerine, and isobutyl alcohol as preservatives for sodium sulphite solutions, and finds that the addition of 2 per cent. of mannite will keep sulphite solutions well for six months, and the addition of 5 per cent. of glycerine for three months. Isobutyl-alcohol is not so satisfactory.—"Eder's Jahrbuch," 1906, p. 45.

C. Welborne Piper finds that the slight alkalinity of commercial sulphite of soda prevents the preservation of stock solutions, and the mixture of alkali and sulphite given in many developing formulæ is worse still in this respect. A stock preservative solution which retains its strength well is made up of—

Sodium sulphite	4	ozs.
Potass metabisulphite	1	oz.
Water	20	ozs.

The acid of the metabisulphite is employed to neutralise the alkali in the sulphite.

The sulphite is dissolved first in boiling water, and the solution is brought to the boiling point and then allowed to cool. When down to anything under 100 deg. Fahr., the metabisulphite is added in crystals and quickly dissolves, producing a solution just neutral to litmus paper. The object of boiling the sulphite is to prevent its crystallising out in cold weather. If not boiled, it does this very readily;

but the boiled solution will last through a fairly cold winter, even if the dark room occasionally drops to near freezing point.

In addition to being an excellent preservative for pyro, this solution preserves itself most admirably. It appears to be always fit for use, however long it may have been kept, and this is notoriously not the case with a simple solution of sulphite, which speedily becomes useless for some purposes (notably for use with amidol) if kept.

The following formula is recommended:—

No. 1.—Pyro	160 grs.
Neutral sulphite sol.	12 ozs.
Water, distilled to	20 ozs.
No. 2.—Soda carbonate	3 ozs.
Water, to	20 ozs.

Equal parts of these solutions are mixed to form the developer, and the mixture is diluted as required. The good keeping qualities of the No. 1 solution are, no doubt, partly due to its dilution, for pyro certainly keeps better in a weak solution than in a strong one, though the contrary is often stated.

At a temperature of 62 deg. Fahr., four minutes' development gives a fairly dense negative. In cold weather it is well to either prolong development to five or six minutes, or use an extra grain of pyro per ounce.

The "neutral sulphite" solution described above works perfectly with amidol, and if the stock solution is looked upon as a 1 in 4 solution of sodium sulphite, the developer can be made up in accordance with any particular formula. If the dry amidol is dissolved in a very stale sulphite solution, effervescence takes place, and a dark-coloured acid solution with no developing power is the result. Alkali may be added to make this solution work, but it will then produce stains. If you substitute for the stale sulphite solution an equally old solution of the "neutral sulphite," the developer works as well as can be desired, and is quite clean and stainless.

Comparative tests with amidol developers prepared with neutral sulphite, and with perfectly fresh alkaline sulphite solutions, show that as regards the keeping qualities of the mixed unused developers there is no difference. One keeps as well or as badly as the other. As found by Messrs. Lumière and Seyewetz, all depends on the dilution. A strong stock solution containing, say, 10 grains of amidol to the ounce, is badly discoloured in two or three days, while a weak solution of normal developing strength will keep for a month or more. The author finds that a solution of five grains to the ounce, after two months, worked excellently on gaslight paper, and produced full density without any stain in a minute's development. A weaker solution will probably keep yet longer.—"P.N.," April 6, 1906, p. 266.

Tylol.—A developer is manufactured under this name by a French firm of chemical manufacturers. It closely resembles metol, but from a brief comparison with the latter in plain aqueous and sulphite solution, Tylol seems to possess rather better keeping properties, for in an open dish there was markedly less colouration in a given time —"B.J.," April 13, 1906, p. 295.

Double Carbonates.—Matthew Wilson gives directions for preparing double carbonates of metals suitable for developers.—"B.J.," Oct. 26, 1906, p. 847. He gives formulæ for the developers.—"B.J.," Nov. 2, 1906.

TIME DEVELOPMENT.

The Personal Equation.—A. Lockett, as the result of experiments made with six workers who at one sitting developed several sets of plates which had received identical exposures, concludes that:

(*a*) What is called the personal element is of comparatively small importance in factorial development, providing average care is used; being, in fact, much less evident and less likely to cause variation in results than with the old system of judging density by inspection.

(*b*) A liberal allowance of light in the dark room (of course, non-actinic) is of the highest importance while watching for the first appearance of the image.

(*c*) Although a medium factor, neither too long nor too short, is probably preferable, there is practically no greater fear of variable results with a large developing factor than with a small one—given reasonable care in watching for and estimating the time of appearance.

(*d*) Some individuals are habitually quicker or slower in noting the emergence of the high-lights than others; but, as a rule, this variation is uniform, and may be allowed for by adopting a proportionally higher or lower factor for the same developer.

(*e*) Within limits, a slight error in judging the time of appearance will have no serious results.—"B.J.," June 15, 1906, p. 464.

Timing by Slip.—Alfred Watkins, in a new edition of the "Watkins' Manual," gives the following method for adopting a time method without calculation by exposing a strip for the same time as the plate.

The developer is simultaneously poured on the plate and the slip (in separate dishes), and when the image appears on the slip the plate (kept covered all the time) is correctly developed.

The plan is based on the fact that with all developers (other than pyro or amidol) the appearance is slowed in proportion to dilution. Thus with hydroquinone diluted five times (four times its bulk of water added), the image in diluted developer will take five times as long to appear as in full strength. It follows that, as the factor for hydroquinone is 5, the slip in the diluted developer will, by its time of appearance, indicate the full time of development for the plate in the full strength developer.

Pyro is not suited for this method. The rule is to dilute to the same degree as the factor of the developer. Make up a little more developer than required for the plate; pour exactly one dram into a separate measure, and fill up with water (of the same temperature) to the same number of drams as the factor of the developer (10 for ortol, 7 for glycin, etc.). The full strength developer is poured on the plate, which is covered up, and the dilute developer on the timing slip, which is in a separate dish. Keep watch on the slip

until the image appears, at which time the plate—whether interior, snapshot, or landscape—is correctly developed, and is rinsed and fixed.

Calculating Times of Development at Different Temperatures.—W. B. Ferguson, K.C., M.A., adopts the following method as easier than the graphic method worked out by himself and B. F. Howard ("Phot. Journ.," March, 1905; see "B.J.A.," 1906, p. 784):—He exposes a quarter-plate behind a graduated screen, so as to receive exposures of fro n 2 to 50 C.M.S. in bands, and cuts the plate into four strips, A and B, and C and D. A and B are developed, say, at 8 deg. C. for five and ten minutes, and the densities measured in the photometer, showing, for example, development factors (γ of) 1.16 and 1.50 to have been obtained. From these κ and γ_∞ were calculated by the method of Mees and Sheppard ("Phot. Journ.," Nov., 1904), and gave κ, .243 and γ_∞ 1.66.

The times for development factor of .8, 1.0, and 1.3 are found by calculation to be 2.75, 3.84, and 6.37 minutes.

Strips C and D are developed at 18.5 deg. C. for 3 min. 18 sec. and 6 min. 36 sec., and the same calculation gone through, whence the times for the above three development factors are found to be 1.81, 2.55, and 4.27 minutes for 1 deg. C.

The "temperature coefficient" (b) can now be calculated from the equation—

$$\log. b = \frac{\log M - \log. m.}{x} = 1477,$$

where M and m are the times registered to obtain the same development factor on each plate, and x is the difference in temperature in the two experiments. Thus the time for any degree is multiplied by 1.477 by $(1,477)^2$ by $(1.477)^3$. . . ., according as the temperature at which development is to be done is 1, 2, or 3 degrees higher.—"Phot. Journ.," May, 1906, p. 182.

STAND DEVELOPMENT.

The following adurol formula is recommended in an editorial on stand development:—

Sulphite of soda	8 ozs.
Carbonate of potash	6 ozs.
Water	20 ozs.

When all are dissolved add—

Adurol	1 oz.

For use take one part of this solution and add 20 parts of water. Correctly exposed plates will fully develop in this in about ten minutes.—"P.N.," Feb. 9, 1906, p. 103.

SELF-DEVELOPING PLATES.

W. F. C. Kelly and J. A. Bentham's Patents.—A photographic plate or film, bearing on itself a dry developing mixture compounded with borax, and developed by the application of water only. The following developer, containing borax as a preservative alkali, can be readily made into a paste, for application to the

plate — viz.: Metol, 2 grains; hydroquinone, 4 grains; potassium metabisulphite (powdered), ½ to 1 grain; borax, 10 to 20 grains; colloid, q. s.; glycerine, q. s. (optional for assisting solubility). When the plate or film requires developing, it is only necessary to place the same in water, when the chemicals will be dissolved and the picture will develop in the usual manner. The additional thickness formed by the extra coating does not interfere with the "roll" films in any way, as there is ample space therefor, including an additional backing of protective paper or other substance, which may be employed between the chemicals and the usual black paper.—Eng. Pat., No. 26,066, 1904; "B.J.," Jan. 26, 1906, p. 70.

The patent of W. F. C. Kelly and J. A. Bentham describes the method of applying to the back of the plate a developer containing gum, or other thickening body, and borax, or boric acid, as a preservative, *e.g.*—

Metol	2 grs.
Hydroquinone	5 grs.
Potass metabisulphite	½ to 1 gr.
Potass bromide	⅛ gr.
Borax	10 to 20 grs.
Gum (or other substance)	¼ gr.
Water:	Sufficient to make a thin paste.

These materials are ground together, applied to the back of the plate, and allowed to dry. When the composition is to be applied to the back of a "roll film," it is necessary to so adjust the constituents as to secure flexibility. The inventors quadruple the above quantities (except the gum) and mix the ingredients with fifty drops of gum arabic mucilage, four drops of glycerine or syrupy glucose, and sufficient water. Instead of incorporating all the constituents of the mixture, they may keep separate the reducing and alkaline constituents, and spread these on adjacent areas on the back of the plate, film, or the like.

Composition as given above may be divided into two or more constituents.

A thin coating or wash of gum arabic or sugar in solution, or a mixture of both, is a protection which is applied over the developing composition when exposure to trying atmospheric conditions is anticipated.

In order to avoid excessive reflection of light from the back through the plate in the case of the single composition, and an unequal reflection in the case of the developer in separate constituents, a "light absorptive" layer is placed between the support and the developing materials; but in certain cases the "light absorptive" layer may be be between the sensitive film and the support, but the inventors make no claim to the combination of sensitive film, absorptive layer, and support, as this forms the subject of Oakley's patent, No. 2,986, of 1895. In the former case the "light absorptive" material may be either a transparent colour, a sheet of opaque substance, or a pigment; in the second case a dye or stain that will wash out during development and fixation. As an example of the light absorptive

medium which is interposed between the sensitive stratum and the support, the following is given:—

Gelatine	1 oz.
Water	16 ozs.

Dissolve by heat and add:—

Crocein scarlet (3.B.)	5 grs.

The solution is applied to the support and dried before coating with sensitive emulsion. For coating the back of the plate a similar composition is used, or, in place of the crocein scarlet or other dye, lampblack or other suitable pigment.—Reference is made to Backelandt's Patent, No. 1,201, 1888, and Thornton's, No. 17,292, 1899; "B.J.," Aug. 10, 1906, p. 632.—Eng. Pat., No. 8,911, 1905.

The non-oxidisability of the developer is said to depend on the use of borax as a substitute for other alkaline substances in the dry composition: although being strongly alkaline when dissolved (as it then hydrolyses with the liberation of caustic soda), it is powerfully acid when dry, and the dry acid borax preserves the film of dry developer from oxidation.—"A.P.," Sept. 18, 1906, p. 258.

Dr. Reiss suggests that the most satisfactory method of making a self-developing plate is to soak it for two minutes in

Hydroquinone	10 gms.
Acetone sulphite	100 gms.
Distilled water	1000 ccs.

and then drying. The developer for plates thus treated is a 3 per cent. solution of potassium carbonate. The sensitiveness of the plates is reduced to about one half. If the acetone sulphite is reduced to half, the sensitiveness will remain the same, but the plates will not keep quite so well.—"Pgm.," Sept., 1906, p. 270.

DEVELOPMENT MISCELLANEA.

Acetone in the Developer.—Dr. Rothmund has proved the existence of compounds of acetone and sulphurous acid, and neutral and acid sodium sulphite. The acetone sulphurous acid is much stronger than sulphurous alone, but as it is monobasic it can make a neutral solution of sodium sulphite alkaline. The formation of this acid will obviously play an important part in mixtures of acetone and neutral sulphite and developing agents.—"Phot. Korr.," Jan. 1906, p. 48.

Acid Bisulphite Lye.—Namias has analysed the commercial acid sulphite lye, and finds that it consists of 23 per cent. of sodium sulphite, 10 per cent. of free sulphurous acid, and 0.7 per cent. of sulphate of soda. This, taking into consideration the small proportion of suiphate, is much purer than commercial sodium sulphite, and he suggests, therefore, that it should be used instead of the sulphite, and the free acid neutralised with caustic or carbonate of soda. If 150 parts of caustic soda are added to 1,000 parts of acid lye, the result will represent 400 parts of anhydrous or 800 parts of crystallised sodium sulphite. Instead of neutralising beforehand,

the lye may be added to the developer and the carbonate of soda increased, and he gives the following as a suitable formula:—

Acid sulphite lye (32 deg. Be.)	60 parts.
Sodium carbonate anhydrous	100 parts.
Potassium bromide	1 to 2 parts.
Hydroquinone	7 parts.
Metol	1 part.
Water	1,000 parts.

This reduces the cost of the sulphite considerably.—"Phot. Chron.," April 15, 1906, p. 201; "B.J.," April 20, 1906, p. 311.

Alkalies in Developers.—MM. Lumière conclude that the caustic alkalies may be substituted for each other in equi-molecular weights. In the case of the carbonated alkalies, the quantity is much larger than the alkali metric equivalent of the caustic alkalies, and even the carbonates do not act in proportion to their molecular weights.—"Bull. Soc. Fr. Phot.," Jan. 1, 1906, p. 32; "B.J.," Mar. 30, p. 246, and Apr. 6, 1906, p. 270.

Chromium Salts in Developer.—The Actien Gesellschaft für Anilin-Fabrikation have patented the addition to a developer, which can be used with sodium sulphite alone, of a salt of chromium, such as chromic chloride, chrome alum, etc., the function of which is to permit of the warming of the developer to 85 to 95 degrees, without softening the gelatine on the plate. The following is an example of a developer made up in this way:—1. A mixture of 2 parts of "amidol" meta-diamidophenol, with 3 parts of chromic chloride is made by dissolving this mixture, together with 6 parts of anhydrous sodium sulphite, in 300-400 parts of water. The clear solution will develop a normally exposed plate clearly and strongly within about six minutes without damaging the coating on the plate; or, if the developing is carried out at 85 to 95 deg. F., the operation occupies only about three minutes. After the developing process is finished the plate is washed with water having a temperature of 105 deg. to 140 deg. Fahr.—Eng. Pat., No. 9,116, 1905; "B.J.," Jan. 5, 1906, p. 15.

Developing Sheets.—D. W. Hart has patented the method of applying chemical solutions to photographic plates, films, papers, and the like in an evenly distributed quantity over the whole surface, and in such a manner that each portion of the surface is, during the whole time of contact, only subjected to the action of the portion of the developer immediately superimposed thereon. A paper is specially made of pure celluiose material, without chemical treatment, and coated with gelatine; also gelatine sheets alone or backed with porous or non-porous elastic supports, these materials being impregnated with developing substances. The method is described as applicable to fixing reduction, etc.—Eng. Pat., No. 9,248, 1905.

One-Tablet Developers.—W. F. C. Kelly has patented a solid developing composition in dry or tablet form, containing borax, as a preservative alkali or accelerator, and only requiring the addition of water. Each quarter-plate tablet may contain: Metol, 2 grains; hydroquinone, 4 grains; potassium metabisulphite (powdered), ½ to

1 grain; borax, 10 to 20 grains; colloid, such as gum tragacanth, or like adhesive, q.s.; glycerine, or other hygroscopic medium, *e.g.*, glucose syrup, q.s. (optional for assisting solubilities). Mix the dry ingredients, add the colloid and glycerine (about two drops of a saturated solution of gum arabic, and one drop of glycerine suffice), then add alcohol continuously, and stir to avoid precipitating the colloid, in sufficient quantity to make the mixture into a paste. Then press the mixture into contact with glass or other moulding surface for shaping the paste into tablets if desired, the said mixture being allowed to dry therein, and when dry, ready for use.—Eng. Pat., 3,164, 1905.

Tanning of Gelatine during Development.—MM. Lumière show that plain aqueous solutions of the developers, with or without access of air, do not tan gelatine. With carbonate of soda, without access of air, there is no tanning; with air (and carbonate of soda) many developers tan in two days, less rapidly, and in some cases not at all, if soda sulphite is also present.

Their results are confirmatory of those of Messrs. Haddon and Grundy, which appeared in the "B.J." for June 5, 1896, p. 356, entitled "The Cause of the Relief in Gelatine Negatives," in which they tested the tanning properties of several of the developers —"Bull. Soc. Franc.," Jan. 1, 1906, p. 32; "B.J.," April 13, 1906, p. 285.

FIXING AND HYPO-ELIMINATORS.

For the theory of fixation by Mees and Sheppard, see under "Emulsions."

Boric Acid in the Fixing Bath.—H. Reeb has been trying to settle the disputed point as to the decomposition of hypo by boric acid. This addition was recommended by Namias (see "B.J.A.," 1906, p. 791), on the ground that this acid does not set free sulphur. Reeb comes to the following conclusions: 1. That with some samples of hypo there is a precipitation of sulphur; with other kinds there is none. 2. If more than 6 per cent. of boric acid is added the solution becomes cloudy, and decomposition sets in. 3. The following is the best composition of the bath:—

Hypo	6 ozs.	.....	300 gms.
Hot water	13 ozs.	.....	700 ccs.
When dissolved add			
Boric acid	394 grs.	.....	45 gms.
Water, to	20 ozs.	.....	1000 ccs.

4. This bath is acid, but as it cannot be used after an alum bath it is less advantageous than an ordinary acid fixing bath containing sulphite and acid.

It seems reasonable to suppose that boric acid and sulphite could be used. In the discussion which followed a paper on this subject, before one of the French societies M. Balagny stated that he strongly recommended the use of boric acid, as he had found that it entirely stopped an attack of incipient eczema of the hand.—"Photo. Revue," March 4, 1906, p. 66.

The Alum Fixing Bath. — MM. Lumière and Seyewetz have examined the hardening action of ordinary and chrome alum in the fixing bath, and comparing the action of the two alums it was found that using a 15 per cent. solution of hypo the greatest insolubilisation of the gelatine was produced with 0.5 per cent. of chrome alum and 1.5 per cent. of ordinary alum. Chrome alum is much superior to ordinary alum, as one-third of the quantity is required, and, further, the gelatine is so hardened that it will stand a temperature of 212 deg. Fahr, whilst with ordinary alum at 167 deg. Fahr. the gelatine softens and strips from the glass. They also find that sodium bisulphite prevents the decomposition of hypo by the alums, and recommend the following formula:—

Hypo	3 ozs.
Sodium bisulphite lye	100-150 ms.
Chrome alum	50 grs.
Water	20 ozs.

The hypo should be dissolved in the greater part of the water, the bisulphite and chrome alum in the remainder, and the solutions mixed.—"Bull. Soc. Fr. Phot.," July 15, 1906, p. 306.

Washing Plates.

Rapid Washing of Plates.—Gaedicke points out that ammonium hyposulphite diffuses quicker than the sodium salt, and gives the following results of experiments carried out on the following lines:—After fixation the plate is rinsed under a tap, placed in a dish with water, and the latter changed every five minutes, and the amount of hypo in the water estimated. The size of the plate used was 13 x 16½ cm. (= 5 x 6 inches).

	A	B
1st Wash Water ...	0·0230 gm.	0·0260 gm.
2nd „ „ ...	0·0040 „	0·0020 „
3rd „ „ ...	0·0010 „	0·0010 „
4th „ „ ...	0·0005 „	0·0005 „
5th „ „ ...	0·0005 „	0·0000 „
6th „ „ ...	0·0005 „	...
7th „ „ ...	0·0005 „	...
8th „ „ ...	0·0005 „	...
9th „ „ ...	0·0000 „	...

A. shows the amount of hypo extracted from the plate when plain water was used. B. that extracted when to the first wash water 10 per cent. of ammonium chloride is added.

It follows from this that when quick washing and small water consumption is a consideration, the plate, after a minute's washing under the tap, should be first laid for five minutes in a 10 per cent solution of ammonium chloride, and then washed in four successive changes of water.—"Phot. Woch," Jan. 30, 1906, p. 41.

After-Treatment of Negatives.

INTENSIFICATION.

Permanganate Intensifier.—T. Thorne Baker gives the formula:—

Potass. permanganate	2 gms.
Hydrochloric acid (conc.)	1 c.c.
Water	100 c.c.s.

The negative, after having been thoroughly washed, is placed in this bath for a period between one and three minutes, during which time the image is transformed into a reddish-pink, and apparently loses very much in density. The clear portions become chiefly discoloured, but no chemical effect seems to take place in them, as on subsequent development they again become clear and white.

A short rinse only, in water, is advisable between the use of the above bath and redevelopment; too long washing appears to lessen the intensification.

Any organic alkaline developer may be used, but hydroquinone with caustic soda is recommended. The red plate, when immersed in the developer, quickly becomes brown, and finally black, and, as already stated, the whites again become perfectly clear. A short washing in water concludes the process.—"Phot. Journ.," Oct., 1905, p. 319; "B.J.," Nov. 10, 1905, p. 889.

An editorial appended to an abstract of T. Thorne Baker's method of above, states that in the treatment with permanganate and hydrochloric acid, there is only brown colouration if excess of permanganate is used, the gelatine being thereby oxidized. Otherwise, with sufficiently long washing, pure white plates are obtained. The small intensification which occurs is perhaps due to the formation of a pigmentary image by the developer. In the method with chromate and hydrochloric acid, chromate of chromium oxide is formed with silver chloride. The former is completely decomposed with long washing, and perfectly white plates are obtained. The use of calcium chromate is purposeless, as potassium bichromate will give the same result.—"Chem. Zeit.," Dec. 23, 1905, p. 415.

Mercury-Sulphide Intensifier.—C. Harold Smith advises the following method:—

A.	Mercuric chloride	200 grs.
	Water	20 ozs.
B.	Sodium sulphide	100 grs.
	Water	20 ozs.

The plate is bleached, partially or wholly—but seldom the latter—in A, and, after washing for about ten minutes altogether in several changes, is darkened in B. For a negative tending to hardness from under-exposure, it is best to apply A with a clean sweep to the dry negative and allow it to act only until the surface has whitened, rinsing quickly, and washing prior to darkening.

The results have proved to be permanent (eighteen months), and a great increase of density is obtained.—"Phot. Scraps," Aug., 1906, p. 59.

Sulphide Intensification.—Clarence Ponting recommends the usual bleach and toning baths (as used for the "sulphide" toning of bromides) for moderate-power intensification of negatives. The "intensifier" acts chiefly by changing the colour of the deposit, and the shadows of the negative remain clear. The formula is:—

Bleaching Solution.

Potassium ferricyanide	80 grs.
Potassium bromide	160 grs.
Hot water	8 ozs.

Blackening Solution.

Sodium sulphide	¼ oz.
Water	20 ozs.

—"P.N.," March 23, 1906, p. 226.

Intensifying Reduced Negatives.—Dr. Hauberisser suggests the following method for improving negatives which have been too much reduced in an ammonium persulphate bath. After thorough washing the negative is treated with a physical developer, such as the following, first suggested by Wellington:—

Ammonium sulphocyanide	120 grs.
Silver nitrate	20 grs.
Sodium sulphite	120 grs.
Hypo	25 grs.
Potassium bromide	3 grs.
Distilled water	1 oz.

One part of this solution should be diluted with 9 parts of water, and then 2 parts of rodinal or concentrated edinol developer added, and the plate flooded with the mixture, in daylight, and left until sufficiently dense. It may be pointed out that, as this physical redevelopment takes some three to four hours, it would be more reasonable to exercise a little greater care whilst the ammonium persulphate is in use, and arrest its action with a sodium sulphite bath.—"Phot. Korr.," Dec., 1905, p. 545.

REDUCTION.

Persulphate Effect with the Iron Reducer.—John Bartlett obtains with the ferric chloride reducer the softened reduction already described by him as the property of an acid Farmer's reducer. ("B.J.A.," 1906, p. 796). He finds if the iron reducer is made up with citric acid, three or four times the weight of the iron salt, the reduction is much more harmonious and the shadows are not reduced too much. Formula:—

Percholoride of iron (solid)	120 grs.
Citric acid	420 grs.
Water	16 ozs.

Should further reduction be required, a dip for a minute or two in a weak hypo solution will further diminish the density. Care must be taken, however, not to allow the negative to remain too long in the hypo solution.

An undertimed negative, that is, one in which the high-lights are strong and the shadows weak, ought not to be submitted to the

hypo, but merely subjected to the perchloride and citric acid bath when the high-lights have been brought down to proper relation. The negative may be intensified so as to make a good printer.—"Cam.," June, 1905, p. 223.

Persulphate-ferricyanide Reducer.—M. Coustet, writing on the well-known properties of Farmer's and persulphate reducers, suggests a combination of the two, particularly for flat negatives, fogged all over. Although intensification judiciously carried out may be useful in such cases, we really want to reduce the fog and reduce the high-lights. In cases, therefore, where plates have been over-exposed or over-developed, he advises the use of the following:—

Ammonium persulphate	20 grs.
Potassium ferricyanide	2½ grs.
Hypo	25 grs.
Water	1 oz.

The proportions may be altered to suit individual cases, bearing in mind that the ferricyanide acts more energetically than the persulphate. The mixture, as above, will remain clear whilst in use, but should be thrown away when done with, as it will not keep. In order to arrest the action of this bath, it is advisable to plunge the negatives at the moment of correct reduction in a 10 per cent. solution of sulphite of soda. An alternative method of using these reducers is to make them up into separate solutions and place the plate alternately into each, with or without washing.—"B.J." (from "Phot. Gaz."), Dec. 8, 1905, p. 969.

Persulphate-Effect Reducer.—Dr. Lüppo-Cramer states that a mixture—

Nitric acid	50 ccs.
Ammonium sulphocyanide 20 p.c. sol.	20 ccs.
Water	30 ccs.

—will reduce the high lights of a negative exactly in the same way as ammonium persulphate. The action is rather slow, and it is advisable to immerse the negative before treatment in a 2 per cent. solution of chrome alum and dry. On the other hand, he states that a mixture of a 5 per cent. acidulated solution of ammonium persulphate with 2 per cent. solution of ammonium sulphocyanide acts like Farmer's reducer, and attacks the shadows first.—"Eder's Jahrbuch," 1906, p. 237.

NEGATIVE VARNISHES.

Carbon Tetrachloride Varnishes.—E. Valenta suggests the use of carbon tetrachloride as a solvent for various resins which will give good cold negative varnishes. Carbon tetrachloride, CCl_4, is a colourless, pleasant-smelling heavy liquid of great dispersive power, which boils at 138 deg. F. The specific gravity is 1.63; it is miscible with alcohol and ether, insoluble in water, and dissolves oils and various resins fairly easily. A solution of 5 to 10 parts of gum dammar in 100 parts of carbon tetrachloride gives, after filtration, a clear solution, which, poured on a glass plate, leaves behind, after evaporation of the solvent, an absolutely clear, hard, and firm film of varnish This dammar varnish is excellent for gelatine negatives as a cold varnish, and may also be used in suitable concentration for varnishing collodion plates.

Mastic also gives a useful varnish, although it is less soluble than dammar. To make such a varnish 5 parts of mastic should be dissolved by the aid of heat in 80 parts of carbon tetrachloride, allowed to cool, and then filtered, and the varnish kept in well-corked bottles. Both these varnishes give films which, when quite hard, take the pencil well. It is difficult to make a shellac varnish with carbon tetrachloride, as this resin is very insoluble in it.—"Phot. Korr.," April, 1906, p. 178.

RETOUCHING NEGATIVES.

Splatter Work.—Arthur Whiting directs as follows when lightening parts of a negative or treating it to represent shingle, stones, flowers, snow, etc. To apply, first lay the negative almost flat on a table, but inclining slightly towards the operator. Cover every part not requiring to be splattered with bits of paper. Then take a fine bristle nail or tooth brush, which, after being dampened, has been lightly charged with liquid Indian ink, Indian red, or "photopake." Holding the brush over against the negative, bring the teeth of a small-toothed nursery comb smartly over its surface in the direction of the operator, when a spray of splashes will migrate from the brush to the negative. When the work is applied over grass it will, with a little subsequent pencilling, give the appearance of flowers, of shingle if applied over paths or roads, or of waterweed and lilies over water. Some skill is needed to cause the smaller splashes to be deposited over the parts of the scene farthest away from the camera, and the larger ones in the foreground.—"B.J.," April 6, 1906, p. 267.

"*Clouding*" *Portrait Negatives.*—Arthur Whiting gives the foling directions:—Varnish the retouched (or otherwise) negative with what is known as matting varnish, of which the following is a good formula, viz.:—

Seed lac	2 ounces.
Sandarac	2 ounces.
Oil of lavender	½ ounce.
Castor oil	½ to 1 ounce.
Methylated alcohol	40 ounces.

The addition of some powdered glass will facilitate the solution of the gums, and gentle heat usually has to be used also. When dissolved allow to stand for several hours, then decant, and filter once or twice (an advantage). Great care must be used to ensure both negative and varnish being absolutely free from dust, as it is fatal to success in this class of work. After the negative is cold rub the varnish gently down with the fingers, which have been previously dipped in powdered resin. When a uniform matt surface has been obtained wipe off with cotton-wool and keep the latter for further use, as dusting the negative with this impregnated wool is infinitely superior as a preliminary to dipping the fingers in powdered resin.

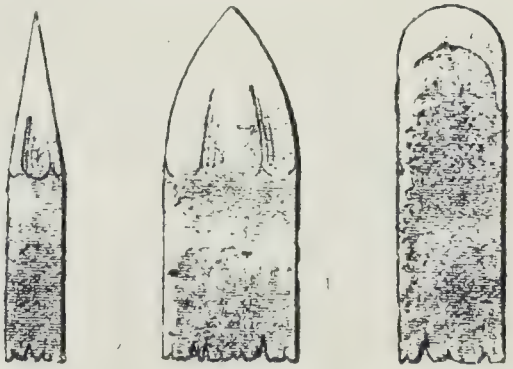
The negative is now ready for clouding, which is done with the

aid of a stump (a tint-stump for broader surfaces) and some electrotyper's plumbago.

For the stump choose a very firm-pointed paper, about half an inch or more in diameter, and rotate the pointed ends on a piece of fine glass-paper until they present a perfectly smooth and silky appearance with fine points. A tint-stump can be made by screwing a small flat button on to the end of a penholder, and covering the knob thus formed with two or three thicknesses of ordinary surgeon's lint.

Place some of the plumbago upon a washleather pad, and work it well into the leather with the ordinary stump. When the latter is evenly charged (not too heavily) apply it over the background of the negative so as to form clouds " in negative," the best kinds for the purpose being those known to meteorologists as cumulus, cumulo-stratus, and " scud." It is important to make the highest lights in the clouds less intense than those of the features, otherwise the artistic quality of the production will be lost, and the picture look " made up." Let the work, therefore, be of a subdued tone, the highest lights equalling in depth the middle tones of the face, and placed on the shadow side of the latter. By doing so the portrait will be thrown up, and if the clouds on the lighter side of the face are only faintly portrayed, it will give the effect of light striking them after it has passed the sitter, and will cause the background to build up and harmonise with the rest of the photograph instead of detracting from it. Again, it sometimes happens (if the clothing is of a similar tone to the background) that the shoulders seem to merge into it, and when this may be undesirable it is easy to bring them into relief by clouding the latter over their immediate vicinity, any overlapping of the work being afterwards erased with a retouching knife, used so as to glide over the varnsh without scraping it.—" B.J.," Dec. 29, 1905, p. 1,025.

Local Reduction.—Wurtz recommends the use of a pad of absorbent cotton wool, saturated with absolute alcohol, and lays great stress on the importance of this and tripoli powder. With this,



halation or local dense places can be reduced without showing any scratches or other marks, as the tripoli is so fine. Failing tripoli,

he suggests the use of a tooth powder. It is as well also to cut three scrapers out of hard wood, as shown in the accompanying figure half their natural size. Round these should be wound the cotton wool, which is then dipped into the alcohol and tripoli. It is possible to scrape down quite fine spots and places with one of these, which are shaped like a pencil, a stump, and the left-hand one shaved off to a wedge shape. This " white retouching," as the author calls it, should be performed before the ordinary retouching with pencil.—" Photo. Revue," April 15, 1906, p. 115.

Titles on Negatives.—W. Shenton writes the titles on a piece of transparent tissue or tracing paper, laying it over a piece of ruled white paper as a guide. A No. 1 brush and any opaque colour are used. A little retouching medium is then applied to the part of negative where title is to go, the title placed carefully on prepared space, painted or printed side down, and after being pressed into contact, another fairly liberal coating of medium applied, which will make the paper quite transparent, and protect the whole thing. With a little practice the lettering can be done very neatly and effectively, and if the superfluous paper is trimmed off before applying to negative, nothing shows on finished print but the lettering. The medium must be applied with a brush, both before and after placing title, as by rubbing on in usual way there would be insufficient to make the paper properly transparent. —" B.J.," Aug. 31, 1906, p. 698.

Retouching Negatives—J. W. d'Anter uses for such work as is usually done with a knife a composition composed of fine cutting or abrading powders, in fine division, combined with various waxes or similar substances to form them into a solid substance, which can be compressed or moulded into convenient shape for use as a crayon or pencil, and be sharpened to a point so that it can be used as an erasing point. These moulded and pointed substances are used in conjunction with a lubricant, which is called a medium, and which is composed of various fine thin oils, such as paraffin, turpentine, and the like, or a mixture of them. This medium is smeared on the parts of the negative to be worked upon, and the work is then executed by means of the pointed substance, which is worked with a delicate rubbing motion, and removes the surface as much as is required, instead of cutting or shaving off the same with a knife.—Eng. Pat. No. 24,816, 1906; " B.J.," Oct. 5, 1906, p. 793.

Reversed Negatives.—R. Zima strongly recommends the following method of making reversed negatives :—A well-cleaned sheet of glass should be rubbed over with a 0.5 per cent. solution of silicate of potash, and then coated with a 2 per cent. solution of gelatine, preferably hard collotype gelatine, and dried. It should then be sensitised in a 2 per cent. solution of ammonium bichromate and dried. It is then to be exposed under the negative, the duration of exposure being controlled by a photometer, in which should be used a strip of gelatine paper, sensitised in the above bath. After exposure the plate should be well washed in running water till the film is free

from colour, and to remove the reduced chromium salt it can be immersed in a very dilute acid sulphite solution or a 2 per cent. solution of metabisulphite of potash. The plate should then be immersed in a solution of platinschwarz M, a dye made by Meister Lucius and Brüning. This dye only stains the unhardened gelatine and a negative is thus obtained, which is absolutely free from grain. This process should be particularly useful for collotype and carbon workers.—"Phot. Korr.," Sept., 1906, p. 428.

V.—PRINTING PROCESSES.

POSITIVES DIRECT.

A Double Film Process.—G. N. Piper has patented the use of a material bearing partly transparent, partly opaque, coatings, to which an emulsion is also applied, exposure being made in the camera through the material and the first coating. Barium sulphate, suspended in collodion or gelatine, is suitable for the coating. The negative image is reversed by solution of the silver image and development of the unaffected parts or by other methods.—Eng. Pat. No. 22,735, 1905; "B.J.," June 8, 1906, p. 455.

Positives Direct in the Camera.—J. T. Hackett employs the following process: Any speed of plates that work perfectly free from fog will do. For changing, any safe light may be used, as preferred; but the development must be conducted by a safe but rather bright yellow light, otherwise the progress cannot be seen.

The exposure need not be more than half that required for a negative, and must not exceed that necessary for the latter. Any developer that does not stain or fog the plate can be used.

Developer:—

A.	Distilled water	20 ounces.
	Neutral potassium oxalate	6 ounces.
	Potassium bromide	6 grains.
	Oxalic acid, enough to make the solution distinctly acid to blue test paper. This solution keeps in good condition for several months.	
B.	Distilled water	4 ounces.
	Sulphuric acid (or citric acid), enough to make the water distinctly acid to blue test paper.	
	Iron protosulphate	1 ounce.

As this solution does not keep in good condition very long, it is best to mix it fresh every day. To develop, one ounce of A and one dram of B are mixed just before use. For more density, more of B solution is employed, and vice versâ. The solution develops two or more plates if used within half an hour of being mixed.

As soon as all the details in the shadows that are desired to appear in the finished picture are visible by reflected light, development is stopped as quickly as possible by rinsing the plate in two or three baths of dilute hydrochloric acid (1 in 120). It is then quickly rinsed in clean water, and fixed in any good acid fixing bath. It is well

washed in clean water, rinsed in two or three more of the acid baths, again rinsed in water, and then whitened in

Distilled water	10 ounces.
Ammonium chloride	½ ounce.
Mercuric chloride	½ ounce.

This bleaches the image through to the glass in about three minutes in hot weather, longer in cold, and the plate is then again rinsed in two or three changes of the dilute acid, then in clean water (distilled, if possible), and set up to dry. When dry, it may be varnished with celluloid or other colourless varnish, if the pearly whiteness of the picture is to be retained; if not, a good shallac spirit varnish or a crystal positive varnish may be used, which will tint the picture more or less, and make it resemble very closely a glass positive by the wet collodion process.

This picture must be backed up with black or maroon-coloured velvet or velveteen, as black varnish will ruin its appearance.—"Phot.," Oct. 2, 1906, p. 278.

Restoring Daguerreotypes.—As the pictures have no protecting film of any kind they should be handled with every care, as a touch will spoil them. The film of tarnish which is the cause of discolouration in Daguerreotypes is removed with a solution of potass cyanide. If there is any dust on the picture which cannot be blown off it should be allowed to remain, as it will be removed in the operations. Its removal, even by a camel-hair brush, if it be of a gritty nature, would be liable to scratch the image, and a scratch once made cannot be eradicated. The next thing is to wet the picture evenly, and this cannot be done direct with water, as the surface is very repellent to that fluid. The plate is first flooded with alcohol for a minute or two, and then put under a gentle stream of water from the tap, until all apparent greasiness is removed. Then, having ready a solution of cyanide of potassium, a little is poured over the plate and flowed backwards and forwards until the tarnish has been dissolved off. No definite strength for the solution can be given, as the cyanide of commerce varies so much—from 30 to 90 per cent. The best way, therefore, is to make up a pretty strong solution and then add a little of it to some water, gradually adding more until the tarnish begins to yield, and then allow time for its complete action. The solution may be used in a dish; but the better method is to pour it on and off, as then it can be applied locally, if desired. The tarnish having disappeared, the plate is well washed under the tap, and finally rinsed with distilled water. If the final washing is with common water, a thin veil is left from the lime or other impurities in the water. Lastly, the picture is dried—and the drying must be done properly, or streaks will be left. The plate is held by one corner—say, the bottom left-hand one—with a pair of pliers and flooded again with distilled water and drained from another corner, say, the right-hand one. From this point the slope of the plate must not be changed. The flame of a spirit lamp is then brought under the highest corner, and, as this dries, the plate is gently raised so that the drying proceeds regularly downward. If there is a stoppage in the drying a mark will be caused which

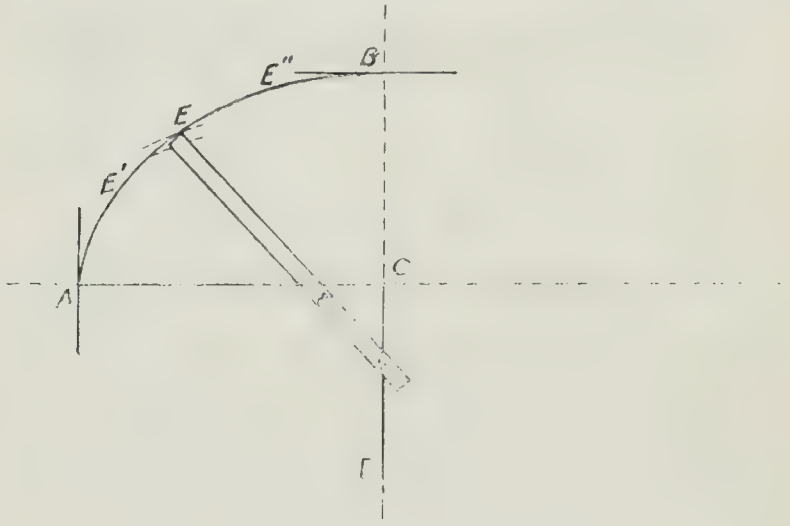
it is almost impossible to get rid of. In the drying, too, much heat must not be employed, or some of the mercury forming the image may be vapourised and the picture weakened.

The work being finished, it only remains to hermetically seal the plate and replace it in its case. This is done by binding the picture, the mat, and the glass together with a thin hard sized paper, or goldbeater's skin, as lantern slides are bound up. The best cement, perhaps, is flour paste; but gum should not be used, as when dry it is liable to split off the glass and metal. Most of the glass used for glazing Daguerreotypes was thick, and had its edges ground to give a tooth to the cement.—"B.J.," Nov. 3, 1906, p. 863.

Printing Methods and Accessories.

Vignetting.—"E. J. H." advises the ordinary picture-frame (Λ) suspension of the printing-frame by a cord from an open doorway or a clothes-line. If a weight is attached to the frame it will swing for a considerable time. It will be found that the frame rocks sideways in its swing, thus allowing the light to enter the vignetting card in all directions.—"A.P.," April 24, 1906, p. 341.

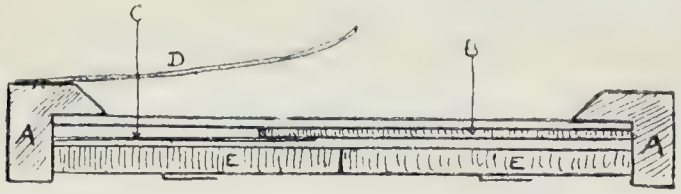
How to Cut an Oval.—J. A. C. Branfil gives the following directions:—The two desired dimensions of the oval are drawn in lead pencil on red paper (on which the pencil marks are plainly visible). The paper is then folded in four along the two lines (A B, A C). Two short lines, ruled at A and B square with the axis, and pencil lines A C and C D are drawn along the axis. (N.B.—The dotted



straight lines on the diagram represent the folds in the paper.) Next we mark off on a piece of card with a straight edge the points F and G, making E F = B C, and E G = A C. Then when F and G are so placed that they correspond with the major and minor axes (as in

the diagram), the point E will touch the circumference of the oval; in this way four or more points may be determined in the quarter oval we wish to describe. Having found these, the curve may be drawn with a French curve, or, as has been done in the above diagram, with any circular objects that may come to hand. The shortest and longest radius curves are extended in dotted lines to show how they should be drawn, and the curve of intermediate radius "EEE" must be tangential to those first drawn. Care should be taken to start the curves at A and B at right angles with the axes, which object is facilitated by the two short lines previously drawn. Before cutting out the disc some mark should be made crossing the curve, so that at any future time the disc can be replaced in the mask exactly as it was originally. The paper is now again folded, and holding the folds together at the left-hand side with a bull-dog clip, with a sharp pair of scissors we cut through the four folds along the curved line, commencing at A.—"Phot.," May 15, 1906, p. 393.

Combination Printing.—E. R. Human employs larger size printing frames than the negatives in use, as, for instance, 12 x 10 frame for 1-1 plates, 10 x 8 for ½-plates, and so on. A sheet of clear glass was put in the frame, and the negative was placed on this so that the hinged back just caught the top of it by, say, some 1½in.; if a whole plate, smaller negatives *pro rata*. Should it have been desired to extend



the lengths of the print by adding extra sky, the extended end was protected by a sheet of opaque paper, the frame was then turned over and a sheet of cardboard with a turned-up edge was fixed into position, so that it covered the horizon line; the whole was then put out to print in the shade. The figure will make this all clear, A A being the frame, B the negative, C the extending protecting paper, D the vignette, and E the hinged back. By the use of the larger frame it was pointed out that extended skies could be easily obtained, foregrounds could be added, or a negative taken landscape way of the plate could often be made a better shaped picture by taking a little out of the middle, or it may be only one end, and by extending the sky making an upright picture of 10 to 11in. by 7 or 8in., this very often proving an improvement both to shape and subject. Thus cattle which got into a picture could by this method of vignetting be taken out and new grass or foreground put into their place by the simple aid of two printings as for the sky, using the vignette at the reverse end; this method was followed for all papers giving a visible or semi-visible image; for carbon and other papers of that class, marks were made upon the edge of the printing-frame, and the vignette used in the manner described. For bromide the

larger frame was still used, together with the marks, and a sheet of cardboard was carefully brought from the top or bottom of the frame to the horizon line, and then kept upon the move for from 1 to 1½in., with a to-and-fro movement. Using these methods, skies or foregrounds could be put into pictures.—"B.J.," Nov. 10, 1905, p. 893.

Introducing Figures into Negatives.—Harold Baker recommends the following process for substituting one head for another in a group or portrait as giving prints which show no signs of manipulation. It consists in removing the head, or figure, from one negative and putting in the other. Calling the negative to which the figure is to be added No. 1, and the negative from which the figure is to be taken No. 2, we will suppose that the head of a child has to be changed. We take No. 1, and, with a sharp knife, cut a line round the head and neck, taking advantage of the lines at the top of the dress to conceal the joins; the film *within* the line must then be scraped away till the glass is quite clear; then a little pure thin gum is taken on a small brush and painted over the patch of clean glass, and the negative is put aside for a few minutes to dry. Now place it in a retouching desk and lay negative No. 2 over it, so that the clear patch of No. 1 is exactly under the part of No. 2 that is to be transferred. Next cut a clean line with the sharp knife through the film of No. 2 to exactly fit the bare patch of No. 1, and scrape away the film *outside* the cut, to isolate the piece to be removed. Then mix some methylated spirit, three parts, with water, one part, and into an ebonite or guttapercha cup put a few drops, say, three or four, of hydrofluoric acid, and pour into it about half an ounce of the mixture of spirit and water. Lay negative No. 2 on a fairly flat surface and with three small slips of wood, tapered to wedges, level the negative, and pour some of the dilute acid upon the part to be stripped. In a few minutes the edges of the film may be tried with a thin slip of wood—a match shaved thin at one end will do very well. If the edges are free from the glass the film may be folded over towards the centre and laid flat again all round to ascertain whether the piece of film is quite free. If quite loose, some of the spirit should be poured over to moisten it and to wash away the acid, and a piece of thin white paper, such as foreign notepaper, is laid on the film and gently pressed upon it, and then carefully raised, when the piece of film should adhere to the paper. If it does not, the paper should be again gently pressed down and lifted at the edge again until the edge of the film can be seen. Now, a little touch of the thin slip of wood will raise a bit of the film from the glass and make it stick to the paper, which should be raised very slowly, bringing the film with it. The paper with film attached is now laid down on negative No. 1, so that that piece of film fills the gap prepared for it. The top of the paper is moistened with the spirit and water and carefully raised so that the piece of film is left sticking in its place on the negative. It may need a little coaxing with the slip of wood to do this. In ten minutes the composite negative is ready for the joins to be touched up, where necessary, with scraper and spotting brush. It is important that the two negatives should be equal in printing density, but slight differences can be adjusted with matt varnish, etc.—"B.J.," Oct. 27, 1905, p. 844.

Registration in Multiple Printing.—Nelson K. Cherrill describes the system of register used in the printing-frame invented by him and sold by Houghtons Limited.—"Phot.," Dec. 19, 1905, p. 503.

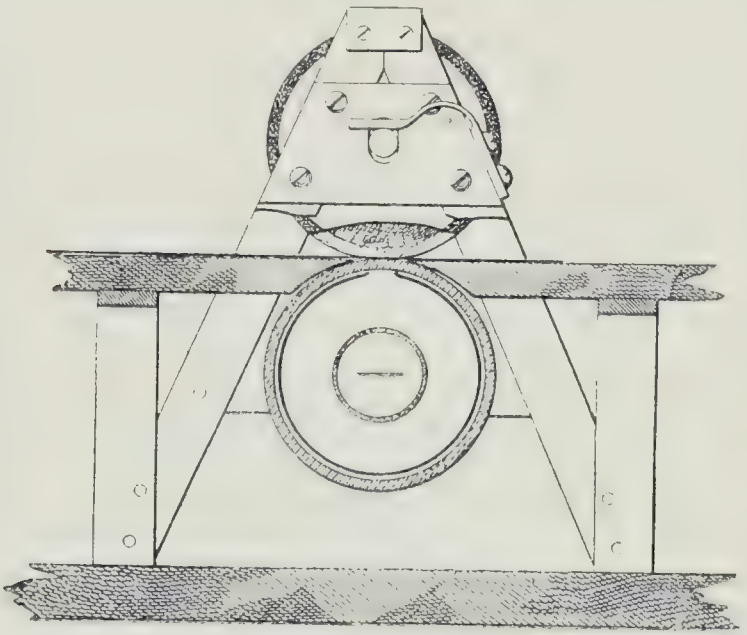
Printing by Arc Light.—C. H. Hewitt gives his experiences in the use of arc lamps of the Westminster enclosed pattern for printing on print-out papers. The lamp is best suspended near the floor, so that the printing frames may be set all round in a ring. By having a circular gallery a double ring of frames may be printed, one ring above the other. A good average distance from the lamp is two to three feet. A number of frames which may be printed at once is not an important point, as the time of printing is so short. For instance, with a negative of reasonable thickness, a platinotype print may be made in two or three minutes under ordinary working conditions, and in less time if it is held nearer to the lamp and kept moving to equalise the light over the negative. P.O.P. or collodio chloride will require a little longer, and carbon longer still. When the lamp is burning steadily, the crater of the positive pole being in the centre of the end of the carbon, the light is practically uniform all round the lamp. Occasionally through imperfections in the carbons or inaccuracy of alignment of the two carbons, or, through the enclosing of the arc not being quite perfect, currents of air affecting the arc, the light is brighter on one side. But under normal average conditions the light is uniform, and if the negatives are even in thickness and printing quality, it is quite possible to print by time. The lamp should be suspended so as to swing clear of everything.

To prevent scorching of the woodwork or floor, a sheet of asbestos is an advantage. The heat given by these enclosed lamps is considerable, and in carbon printing it is very necessary to keep the frames at a sufficient distance so as to avoid heating the carbon tissue. Tissue, overheated, becomes practically insoluble, and even if only partial insolubility exists, the degrading of the high-lights is fatal. With any printing process it is well to have the negatives a little stronger in contrast, as the powerful light penetrates the opacities of the negatives more than ordinary daylight. The greatest difference between daylight and arc light prints from the same negative is noticeable in the case of the carbon process. Where the tissue is sensitised by the worker himself it is possible to get excellent prints from ordinary negatives by using a weaker sensitising bath, going even as far as a 1 per cent. bath, so that no trouble need be apprehended.

Another point to be observed is that when using such a concentrated light the Newton's rings formed by pressure of the negative against the sheet of glass in the printing frame, will print on to the printing paper. This occurs sometimes when making contact dry-plate transparencies in the dark room, using incandescent gas or electric lamps, if the frame is not kept moving, and the same remedy may be applied when printing ordinary daylight processes by the enclosed lamps.—"B.J.," March 2, 1906, p. 164. (See also under "Portraiture.")

Machine Printing from Film Negatives.—An American machine consists mainly of two rollers about three inches in diameter, similar

to the rolls in an ordinary clothes wringer, mounted one above the other; the upper one is solid, covered with soft felting material, and runs in slotted bearings at each end, having pressure springs above to exert pressure on the lower roll. This latter consists of a glass cylinder, having a metal plug in one end and a shaft to fit in a bearing in the supporting frame. The other end of the glass roll is open, and is held in position by outside roller bearings, supported in the frame. On the interior of the transparent roll is a shade held stationary, extending the full length of the roll, which has a slot in its upper part directly under the contact point of the two rolls. Supported upon another removable frame is an incandescent candle-



shaped electric light bulb, made long enough to equally illuminate the slot in the shade within the glass cylinder, or, in other words, to illuminate only the section of the drawing or film at the actual point of contact of the two rolls. The electric lamp is inserted at the open end of the glass roll. Gears at one end of the rolls cause the latter to rotate with equal speed. In front and behind the rolls are platforms arranged for feeding in the drawing as the rolls are rotated. It is highly essential in this machine that the rolls should revolve with a continuous, steady motion, in order that the light may act equally upon the whole sensitive surface. An uneven movement will show in the form of lines across the print. It was found that a small electric motor produced the right effect, although the machine could be operated as well by a spring or weight suitably geared up.

In operation the sheet of drawing is laid upon the platform, then over it is laid a sheet of slow bromide paper with the sensitive side

upward, the motor is started, and the drawing and sensitive sheet are pushed or fed to the two rolls. The time of exposure, or of the passage of the drawing through, is about ten seconds. The exposed sheet is then developed and duplicates are obtained by simply repeating the operation, all in a dark room. The time of exposures can be varied by inserting resistance in the motor circuit to make the motor rotate faster or slower if the drawing is thin or thicker.

In the case of film negatives, the intensity of the light may be reduced by interposing between the lower glass light roll and the negative one or two sheets of translucent celluloid.—"Amer. A.P.," Dec., 1905, p. 575; "B.J.," Jan. 5, 1906, p. 13.

Gelatine and Collodion, P.O.P.

PRINT-OUT EMULSIONS.

Paper for Emulsions.—I. Hoffsümmer patents the application to a raw paper (of wood pulp or other cheap material) of a fibrous protective coating of thin paper, fabric, etc., which is laid on the raw paper by means of an adhesive, etc. The fibrous layer is stated to prevent the penetration of the emulsion better than other applications, such as that of baryta, but it is also stated that baryta may be applied in addition to the fibrous coating.—Eng. Pat., No. 17,303, 1905.

In a later patent Hoffsümmer directs that this upper layer should be of pure photographic paper, such that the emulsion may partially penetrate.—Eng. Pat., No. 2,057, 1906; "B.J.," Aug. 31, 1906, p. 695. p. 695.

L. Robicsek patents the omission of the baryta coating in making gelatine emulsion papers to obtain prints which can be coloured through to the fibres of the paper.—Eng. Pat., No. 7,693, 1905.

Emulsion without Free Silver.—MM. A. and L. Lumière describe a new and patented P.O.P. It is pointed out that the vehicle for the silver salts, whether collodion, albumen, caseine, or gelatine, and even the cellulose of the paper itself, will in a short time reduce the soluble silver salts, such as the citrate, lactate, nitrate, etc. This reduction is favoured by heat and damp, and even the most careful method of packing will not prevent it. The presence of these free silver salts requires an absolutely pure paper—one especially free from metallic particles—and, notwithstanding the great advances in the manufacture of the raw papers, this trouble cannot be entirely obviated. Silver stains on negatives and brown stains on the prints due to the accidental contact of hypo, and the comparative insensitiveness and want of correct gradation, are also due to the free silver. The authors have endeavoured to find some substances which would hasten the reduction of silver chloride, and they find that whilst the amines do so to some slight extent, the phenols are much more active, and especially the di- and tri-phenols. It is, of course, well known that certain metallic salts have the same effect, such as the proto-salts of manganese, the nitrates and the arsenites. All these reducing substances can be used in emulsions in which the by-products

of the formation of silver chloride are present, or in washed emulsions which only contain pure silver chloride; also in emulsions in which the vehicle is either gelatine, collodion, caseine, albumen, or other colloid. The most useful of all these substances appears to be resorcine, and a special paper has been patented in which there is no free or soluble silver salt which is obviously free from all the defects previously enumerated, and which is far more sensitive than the ordinary P.O.P., and can be treated with any of the usual baths.—"Bull. Soc. Fr. Phot.," Dec. 1, 1905, p. 520; "B.J.," Dec. 22, 1905, p. 1,008.

A New Paper.—MM. Lumière give notice of the preparation of a new printing-out paper ("Takis"), which, so far as we are aware, is a new principle in the manufacture of printing papers. The paper is a P.O.P. containing excess of silver nitrate, as well as a developing agent, and it is only necessary to expose the same under a negative for a short time and then immerse in water, when physical development takes place. The novel point is the incorporation of a reducing agent with the emulsion, and the authors state:—"The addition of the developer to an emulsion produces in a very short time the reduction of the soluble silver salt. We have overcome this trouble by the addition of sulphurous acid, either to the emulsion or to the developing agent which we add to it. Here is a typical example of how we prepare our paper with gallic acid: Make a 20 per cent. solution of gallic acid and add 10 per cent. of aqueous sulphurous acid. If, in the dark, 50 per cent. of this solution is added to a gelatine chloride emulsion, there is no difficulty in making or coating the emulsion." Mere immersion of the paper in water after isolation develops the image, and the advantages of a printing-out and a development paper are combined."Rev. Trimest.," May, 1906, p. 23.

Silver Phosphate Print-out Emulsions.—Valenta gives the following method of making the above:—

Raw collodion (3 to 3.5 per cent.)	1.500 ccs.
Phosphoric acid (20 per cent.)	20 ccs.
Citric acid	60 ccs.
Alcohol	100 ccs.

Dissolve the acids in the alcohol and add to the collodion. Then add:—

Silver nitrate, powdered	60-80 gms.
Liq. ammonia	q.s.
Warm alcohol	250 ccs.

The ammonia should be added gradually to the powdered nitrate till a perfectly clear solution is obtained, and then the alcohol added; to the emulsion after this addition should be added:

Ether	250 ccs.

the whole filtered through cotton wool and then

Glycerine	10 ccs.
Alcohol	10 ccs.

added. This gives brilliant prints, which can be either printed right out and toned in the usual way or else faintly printed and developed with an acid metol developer. The tones obtained by the latter process are rich brownish blacks, with pure whites."Eder's Jahrbuch," 1906, p. 150.

Caseine Papers—M. Macaire gives the following formula for preparing a print-out paper with caseine, and it is stated to have all the good properties of albumenised paper and none of its disadvantages. Fifty kilos of commercial caseine are mixed with one kilo of caustic soda or potash and 100 kilos of water, and then vigorously beaten up till the caseine is thoroughly dissolved, and allowed to stand for forty-eight hours. The mixture is then filtered and the caseine precipitated by the addition of acetic acid, and the magma washed till there is no longer any trace of acidity, then rinsed with alcohol and a little ether to remove the traces of water, then allowed to dry spontaneously in the air and powdered. The result is pure caseine.

To make the sensitive emulsion the following formula is used :—

Alcohol	130	parts.
Pure caseine	10	parts.

Heat on a water-bath at 100deg. F. and add

Glacial acetic acid	9	parts.
Calcium chloride (anhydrous)	1.25	parts.

Dissolve and add

Absolute alcohol	10	parts.
Citric acid	2.5	parts.

Dissolve and add

Alcohol	10	parts.
Camphor	3	parts.

Then add the following, which should be heated to 100deg. F. :—

Water	30	parts.
Absolute alcohol	10	parts.
Silver nitrate	10	parts.
Glycerine	3	parts.

After coating, the paper should be dried for two hours at a temperature of 100deg. to 110deg. F. The paper is printed and toned exactly like any ordinary gelatino or collodio-chloride paper.—"Photo-Revue," July 8, 1906, p. 10.

TONING P.O.P.

Toning P.O.P. Postcards on the Small Wholesale Scale.—G. T. Harris, in printing a few gross of postcards per week, works from reproduced negatives, timing the exposure of a batch from a single pilot negative. A toning bath of acetate is preferred to sulphocyanide for regularity of working and good keeping. The tones are rich browns. A stock solution is made of :—

Sodium acetate	16 ozs.
Gold chloride	240 grs.
Distilled water	60 ozs.

The chloride of gold is first neutralised with chalk, and the stock solution requires at least twenty-four hours ripening before being used to prepare the toning bath. The toning bath proper is made up according to the quantity of postcards to be toned. Sixteen grains of gold are found ample for toning two gross of prints. The stock solution is used in the proportion of two drachms to ten ounces of water, or one and a half ounces of stock solution to sixty ounces of water, which forms the quantity used for two gross of postcards,

additional gold from the stock solution being added from time to time as the gold gets used up, until about sixteen grains have been used for the two gross. The sixty ounces of toning bath is contained in a dish about eighteen by fourteen inches, and some two and a half dozen cards, carefully drained from the last washing water, immersed one at a time. After rapidly turning these over once or twice, they should be placed to one side of the dish, and a second like quantity immersed in the toning bath, being kept by themselves. By the time these have been turned over the first batch will be ready to leave the toning bath, and they may be lifted out *en bloc*, and placed in a large vessel of water, with quick separation. Toning with gelatine emulsion is very much quicker than with albumen, and care must be taken not to tone beyond a reddish brown stage, which is reached well under five minutes. By keeping five dozen cards in the bath at one time, toning is soon accomplished, and after washing in one change of water, the cards may be fixed.—"B.J.," Sept. 14, 1906, p. 725.

Combined Toning and Fixing Bath.—Fritz Hansen states that the addition of chalk to a combined toning and fixing bath is quite useless; that if a lead salt is present there is always decomposition of the hypo with evolution of sulphurous acid and deposition of sulphur. Chalk does not prevent this, and if sulphur is set free it will attack the silver of the image.

[This may be perfectly true, but whether there is a deposition of sulphur without setting free of sulphur acids is quite another question, and whether these acids can exist in the pressure of chalk probably depends upon whether the bottle is shaken up or not. One can hardly conceive of sulphurous acid and chalk existing side by side; but as the chalk is an insoluble and heavy body, and would settle to the bottom, it is quite conceivable for the upper strata to be acid and the lowest neutral.—Ed., "B.J.A."]—"Apollo," Nov. 8, 1905, p. 248.

H. Dodsworth finds that after fixing a number of prints on self-toning paper, the resulting solution may be used as a combined bath for prints on ordinary P.O.P. Presumably gold is left in the bath from the self-toning paper.—"A.P.," Nov. 28, 1905, p. 421.

The Combined Bath.—MM. Lumière and Seyewetz have again examined the action of alum in the combined bath, and point out that the tanning action of combined baths containing alum is practically nil, if the baths are made with boiling water, as is usually recommended, because nearly the whole of the alumina is precipitated. Probably as the natural corollary of their researches mentioned above, they now find that the commercial solution of sodium bisulphite entirely prevents any decomposition of the hypo in the combined bath by alum, and suggest the following formula:—

Hypo	5 ozs.
Sodium bisulphite lye	100 mms.
Lead acetate	20 grs.
Alum	400 grs.
Gold chloride	6 grs.
Water	20 ozs.

The authors find that ordinary alum is superior to chrome alum; paper treated with the above bath tones very little slower than with the ordinary bath, blisters are entirely avoided, and the gelatine will stand a temperature of 176 deg Fahr. without melting.—"Bull. Soc. Fr. Phot.," Aug. 1, 1906, p. 323.

Hot Chemical Toning.—E. J. Browne employs the following process for obtaining coloured tones on P.O.P. and other papers. The print is developed up from the half-printed stage with plain pyro solution and fixed. It is then immersed in:—

Saturated solution sulphocyanide of ammonia	15 drops.
Saturated solution acetate of lead...	1 to 2 drops.
Saturated solution bichromate of potassium	2 drops.
Chloride of gold solution	1 drachm.
Water	3 ozs.

It is allowed to remain in this bath until the image assumes blue shadows with pink half tones, and at this stage, if the print is taken out and dried, the colours will be found to be susceptible to change on the application of heat. If desired, however, the pink half tones may be further changed to heliotrope by placing the print in a bath of

Pyrogallic acid	1 grain.
Water	3 ozs.

The high-lights of the picture may now be cleared from the possible staining action of the previous bath, by immersing the print, after washing, in a bath of

Saturated solution ferricyanide of potassium	4 drops.
Water	3 ozs.

It is then washed and dried.

The colours of the print are now sensitive to heat, which may be applied in any suitable manner, say by means of a hot iron or similar instrument held close over the sensitised surface of the print. The blue colours may, in this manner, be changed to purple, red, brown or crimson, according to the intensity of the heat applied. The heliotrope shades, produced by the No. 4 bath, may be changed in a similar manner by heat to varying shades of red.

Yellow tints may now be imparted to the print by inserting it for about two minutes in a bath of

Saturated solution of any soluble lead salt	1 drachm.
Water	4 ozs.

after which it is passed through the following

Saturated solution bichromate of potassium	10 drops.
Water	4 ozs.

The parts already acted upon by heat are not changed to a yellow colour by these baths, but a deposit is formed thereon

which must be afterwards washed off. When the print is dry, the yellow shadows may be changed by means of heat to a deeper yellow or orange colour.—Eng. Pat., No. 22,580, 1905; "B.J.," Oct. 12, 1906, p. 811.

Sulphide Toning.—A. J. Jarman mentions that silver prints toned in gold and fixed can be further toned in a combined gold bath. —"Cam. and Dk. Rm.," 1905.

R. E. Chesterman condemns the process on the ground of impermanency, and recommends the following method for sulphide toning of silver prints:—Immerse the prints as they come from the frames in a 10 per cent. solution of common salt for five minutes, and then wash thoroughly in six changes of water at intervals of five minutes.

The purpose of this washing is to remove all acids from the film and paper, and it may be to some extent curtailed by making the salt bath alkaline with carbonate of soda. This will then neutralise any acid, and at the same time convert the soluble silver salts into chloride.

After this treatment the prints can be fixed, but the hypo solution should be fresh and not have been previously used. The prints should then be washed and again immersed in a fresh and second hypo bath so as to ensure total solution of the silver hyposulphites. Then they must be thoroughly washed, and are ready for the sulphide bath.

The slower the action of this bath the better; it should take at least a quarter of an hour to reach a purple brown tone, beyond which it is impossible to proceed. Rapid toning causes the formation of a silver sulphide which is not the monosulphide, and yellow whites and half-tones and rapid fading are the result.

If actual gold and sulphide toning is required, then the proper salt to use is the aurous sulphide dissolved in ammonium sulphide, and with this an almost black image is obtained which consists of silver monosulphide plus gold.—"B.J.," Jan. 19, 1906, p. 57.

The precautions to ensure permanency in using ammonium sulphide (see "B.J.A.," 1906, p. 813) are:—

1. Print deeply.
2. Place direct in the following, and leave therein for ten minutes:—

Salt	2 gs.
Soda carbonate	1 oz.
Water	20 ozs.

3. Fix thoroughly, and remove all hypo by washing.

The prints are then ready for the sulphide bath of 5 drops ammonium sulphide liquor or 5 grs. soda sulphide in one pint of water. They should require about 45 minutes to assume a rich purple brown colour, which is the best tone the method will give. To combine this method with gold a 15 grain tube of gold should be dissolved in 15 drachms of distilled water and heated to boiling point, and through this solution should be led a stream of sulphuretted hydrogen, till the whole of the gold is precipitated as a black powder. The precipitate is allowed to settle, the supernatant liquid poured off, the precipitate washed, and excess of ammonium

sulphide added till a clear solution is obtained, which may be kept in the form of a stock solution and diluted to the strength of the ordinary gold toning bath as required.

Prints toned in this last solution, which is one of gold monosulphide, may be either blue black, or pure black, according to the depth of printing and the duration of toning. Richer tones may be obtained in this way than by any other, and the prints do not require an extremely long washing after this bath.—"B.M.," Feb., 1906, p. 28.

Reducing P.O.P.—E. J. Wall finds that the cobaltamine reducer ("Sanzol") acts very selectively on P.O.P. prints when made up as the makers direct with citric acid. With citric acid and double the dilution the high-light detail was not eaten out, but the film was stained. It was found that the reducer (in the case of bromide and gaslight prints) permitted of the film being mechanically removed by very slight abrasion with cotton wool.—"B.J.," Feb. 2, 1906, p. 90.

H. E. Smith points out that the ammonia bath used after reducing P.O.P. prints with "Sanzol" must not be stronger than 3 per cent., nor should the prints be left in it longer than three minutes, which is quite long enough when nitric acid is used to acidify. If organic acids are used, however, a longer immersion in the ammonia bath is certainly often necessary to remove a yellow insoluble silver-cobaltamine compound which is apt to be troublesome in this case, and for this and other reasons the use of organic acids for practical work cannot be recommended. Of the organic acids, oxalic would probably be found the best if a purple or bluish toning action is not objected to.—"B.J.," Feb. 23, 1906, p. 158.

Glazing P.O.P.—F. Mordaunt recommends soaking prints on gelatine P.O.P. for five minutes in a 15 per cent. solution of formic acid, after the usual washing and immediately before squeegeeing to glass. This method has been found valuable, particularly in hot climates, when prints were almost too "pulpy" to handle. The formic acid solution may be used over and over again if kept in a well-corked bottle.—"Phot.," Feb. 13, 1906, p. 129.

A Sink for Print-Washing.—J. Ritchie thus describes the plan followed by him:—Fig. 1, A is the sink, B is the waste-water outlet, C is a tube fitted into B. When the water rises to top of C it flows down through C and B. A wire cage on top of C will prevent prints from being carried away, but as this plan only takes the surface water I make a tube (Fig. 2), closed at one end and perforated at the other at least ½ inch up; this is inverted over C. This then takes the water and channels from the bottom of sink first, and no prints can get away. The water can be left running and the prints washed without watching. Anyone wishing to change the water when washing prints can go a step further. I put an air-tight jacket round the tube, as in Fig. 3, with a piece of thin wire on top with a hold-fast with eye to steady tube, fixed in the wall, the air-tight jacket being just large enough to float the tube as the water rises. The tube is inverted over C as already described. When the water begins to overflow at C a suction takes place and down goes the tube D to the bottom, and the tank or sink is soon emptied, when all the water is gone, as will

be noticed by a long gurgling breath. Then the sink begins to fill until the water begins to overflow, and then draws off again, automatically. To prevent the prints from getting in the way, the outlet is best placed in the corner of sink, with a wire screen placed diagonally across the corner, leaving room enough for the tube D



Fig. 1.

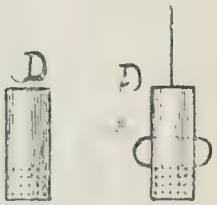


Fig. 2. Fig 3.

to work up and down. It could easily be made to register the number of changes the prints have had. D and C can be taken away and a plug put in B as in an ordinary sink.—"B.J.," Feb. 2, 1906, p. 98.

Spots on Prints.—The cause of spots on silver prints is ascribed by Namais to the presence of acids either in the cards or mountant. He suggests that prints should therefore be soaked, after washing, in a 4 or 5 per cent. solution of borax, the excess of solution blotted off, and the print mounted without further washing. He also recommends the addition of 3 per cent. of borax to the mountant, and states that many professionals have already proved the value of this addition.—"Phot. Korr.," March, 1906, p. 112.

R. E. Liesegang states that, having to explain the cause of some spots on gelatine P.O.P. prints, it was found that some amidol which had been spilt in the room had flown about and settled on the prints. When prints on P.O.P. and bromide and gaslight papers were made and then fixed and well washed and dusted with amidol it was found that a black centre spot was caused, and then there was a white ring round this of about 2 mm. radius, and then a brown ring of about 1 mm. width. In the white parts the silver was bleached, and this, according to Liesegang, is to be ascribed to the absorption of oxygen by the air, the giving up of the oxygen to the silver, and consequent bleaching of the latter; the brown ring is due to oxidised amidol. If hydroquinone be dusted on to a print then only white spots are caused, as the oxidation product of hydroquinone is not so dark.—"Phot. Woch.," March 27, 1906, p. 112.

DEVELOPING P.O.P.

Developing P.O.P.—J. T. Hackett reviews at length gallic acid and other developers of printing-out paper. He mentions, as the first formulæ given for commercial papers, those of Rivot and Co., in

January, 1897, for sensitised albumen paper. The formulæ and directions were:—

Formula for Strengthening and Toning Prints.

Pyrogallic acid	20 grs.
Citric acid	20 grs.
Water	40 ozs.
or,	
Gallic acid	6 grs.
Lead acetate	3 grs.
Water	40 ozs.
Acetic acid	2 or 3 drops.

Expose the sensitive paper in the usual printing frame from half a minute in ordinary light to three or four minutes in a very dull light; stop the printing when a faint image appears. When the day's printing is done, immerse the prints in the solution (one by one), as in the way of albumenised prints. (About five or six minutes will suffice to secure a bright print.) Do not push the toning too far (*i.e.*, development is meant), as the prints dry very dark, through the special preparation of the paper. As the prints tone, transfer them to a dish of water; then to hypo (4 ozs. to 20 ozs. of water) for ten minutes to fix. Wash in running water for one hour. At this stage the prints are red, but are black when finished.

I have given the above directions full, because they will be a good guide when using the same for similar developers for developing faint images on any other sensitised albumenised paper, or on P.O.P. or C.C. papers.

The points for success in using the development formula given below and others of the author, given in "B.J.A.," 1903, p. 738, and in "B.J.," Jan. 30, 1903, p. 98, are as follows:—

(1) Use only yellowish artificial light—paraffin lamp or candle—for handling the paper, examining prints, and other operations preceding the development.

(2) Use as little developer as possible, otherwise the prints develop very slowly and are too flat, owing to insufficient silver salt in the developer.

The following table indicates suitable quantities of developer to use in certain sized glass or porcelain dishes:—

A dish for prints $4\frac{1}{4} + 3\frac{1}{4}$in.	2 ozs.
,, ,, ,, 5 + 4 in.	3 ozs
,, ,, ,, $6\frac{1}{2} + 4\frac{3}{4}$in.	4 ozs
,, ,, ,, $8\frac{1}{2} + 6\frac{1}{2}$in.	6 ozs.

(3) Never attempt to develop more than one print at a time, unless they are small enough to lie side by side in the dish, and then don't try more than two, otherwise they are likely to spoil each other, by sticking together, air bells forming on them, etc. The print or prints (as the case may be) must be turned rapidly over and over in the developer, and air bells prevented, or quickly broken, or they will ruin the print.

(4) Development should be complete in four minutes or less; if longer, the prints become stained.

(5) Use a liberal quantity of the "stop bath" (2 to 4 ozs. of salt in 20 ozs. of water) to arrest development sharply, and free the print

quickly from developer. The prints are then well washed in clean water, and toned and fixed as usual.

The developer is made as follows:—

Stock Solution.

Distilled or other pure water	5 ozs.
Potassium metabisulphite	1 drachm.
Pyrogallic acid (heavy crystals)	4 drachms.

To develop take—

Pure glycerine (or thick gum arabic solution)	2 to 6 drams
Pyro solution (as above)	40 to 60 minims
Water (tap, rain, or well) to make	4 ozs.

The development takes from about four to two minutes, as it becomes quicker with each successive print, as previously stated. I prefer glycerine to the gum solution, as it works quite as well, if not better, than the latter, and is much more convenient to use.

A "stop bath" must be used, because it is impossible to stop the development quickly enough with water alone. I use a very effective and cheap "stop bath," made thus:—

Water (tap, rain, or well)	20 ozs.
Sodium chloride (table salt)	2 to 4 ozs.

As soon as development is complete, the print is immersed quickly in a large dish, containing a liberal quantity of the above "stop bath." The prints must be turned rapidly over and over in the solution for at least one minute; this stops all further development almost instantly. The print is left in the solution, lying on the bottom of the dish face upwards, for about five minutes, and then is transferred to another "stop bath" a quarter to half the above strength until the whole batch of prints has been developed, when they are well washed in clean water before toning as usual.

The fingers must be well washed and dried after they have been in the "stop bath," and before proceeding to develop another print, otherwise finger marks and spots are likely to appear on the prints, and the development will be greatly retarded, if not stopped altogether, owing to the powerful restraining action of the sodium chloride added to the developer in this way.

If a very large batch of prints have to be developed, it will be far safer to get an assistant to take sole charge of the two "stop baths," as then all risk of spoiling the prints or the developer will be avoided, since as each print was developed it could be thrown quickly into the "stop bath," and moved rapidly about in it by the assistant in charge of it.

The prints must be well washed in clean water, after they come from the second "stop bath," and toned and fixed as usual.—"Phot.," Nov. 28, 1905, p. 435.

Similar directions are given by Mr. Hackett in "B.J.," Dec. 8, 1905, p. 978.

Silver in P.O.P. Development.—F. Goldby states he has obtained very good results with the formula of Dr. Blacklock ("B.J.A.," 1906, p. 816), and suggests an improvement in the addition of a little 5 per cent. solution of silver nitrate to hasten development. He finds it easy to obtain developable prints by the combustion of 6 to 12 inches of magnesium ribbon close to the frame.—"B.J." (from "Pharm. Journ."), Nov. 3, 1905, p. 867.

Alum in P.O.P. Developer.—P. Mercier has patented (1) the addition to solutions for the development of partially printed P.O.P. of alum, etc.—to alter the colour of the image—and (2) the use of a bisulphite or mixture of alkaline sulphite, and an acid, in place of organic acids or alkaline sulphites in excess. Suitable developers containing alum or other salts are:—

Pyro	½ oz.	.....	15 gms.
Soda sulphite	310 grs.	.....	20 gms.
Alum	1¾ ozs.	.....	50 gms.
(Or aluminium sulphate	80 to 150 grs.	...	5 to 10 gms.)
Water to make	35 ozs.	.....	1,000 c.cs.

The tone of the developed print is blue or violet.

Gallic acid	½ oz.	.....	15 gms.
Sodium sulphite cryst.	150 grs.	.....	10 gms.
Sodium acetate	1 oz.	.....	30 gms.
Manganese sulphate	80 grs.	.....	5 gms.
Water	35 ozs.	.....	1,000 c.cs.

The tone is blue or violet, whereas without the manganese it is yellowish-red.

In regard to the second claim, the inventor employs a bath containing an alkaline citrate, converted entirely into bi-sulphite by a strong acid without leaving excess of acid, a procedure for which he claims novelty, absence of sulphurisation when the prints are fixed, and absence of solvent action on nitrate of silver in the paper [? for nitrate read citrate.—Ed. "B.J.A."]. A developer thus made is:—

Pyrogallic acid	280 grs.	.....	18 gms.
Sodium sulphite cryst.	280 grs.	.....	18 gms.
Sulphuric acid	34 mms.	.....	2 c.cs.
Distilled water	35 ozs.	.....	1,000 c.cs.

In this bath the acid and the sulphite are in such proportions as to produce bisulphite without any excess of either the one or the other. The improvements in the way of addition of alum (1, above) may be combined with this second part of the invention.—Eng. Pat., No. 11,452, 1905.

Stanley C. Johnson selects the following formulæ for commendation in all cases. The print direct from the frame is treated for five minutes in a 6 grain per ounce solution of potass iodide.

For chestnut tones, pyro, 15 grs.; glacial acetic acid, 15 minims; 90 per cent. alcohol, ½ oz.; water, 9 ozs.

For violet tones, pyrocatechin, 2 grs.; sodium acetate, 10 grs.; water, 20 ozs.; followed by immersion in any ordinary combined bath without intermediate washing. For browns:

Hydroquinone	1½ grs.
Sodium sulphite	6 grs.
Soda, caustic	2½ grs.
Water	1 oz.

Or,

Water	10 ozs.
Gallic acid solution (concent.)	10 ozs.
Sodium acetate	½ oz.
Fish glue	1½ ozs.

"Pgm.," June, 1906, p. 166.

The printing should be carried to about one-third of the full depth and then developed without washing in:

Pyro, 1 p.c. sol.	4 oz.	20 c.cs.
Potassium bichromate, 1 p.c. sol.	77 m.	1.6 c.cs.
Potassium sulphocyanide, 1 p.c. sol.	2 oz. 40 m.	13 c.cs.
Citric acid, 1 p.c. sol.	1 oz.	50 c.cs.
Water	20 oz.	1,000 c.cs.

This is said to give a black tone; warmer tones are obtained by increasing the sulphocyanide.—"Phot. Mitt.," May, 1906, p. 99.

Drs. Knopp and Biltz give the following table of developers and tones obtained therewith on faintly-printed P.O.P. (See also "B.J.A.," 1906, p. 813.)

Developer.	Acetone.	Citric Acid 1:3	Silver Nitrate 1:20	Potash Bichromate 1:20	Chrome Alum 1:30	Various.	Approximate Colour of Fixed Print.
	Drops	Drops	Drops	Drops	c.cs.		
Gallic Acid 15gms Sodium Acetate 30 „	—	—	—	—		—	Brown
	—	—	—	—	5	—	Green
Water 1,000 c.cs. Con. sol. of Gum Arabic 60 c.cs.	4·16	—	—	—	—	—	Green
	—	—	—	—	—	—	Photo. Brown
	20	—	—	—	—	—	Gold Tone
Metol 2 gms.	—	10	—	—	—	—	Brown
Water 1,000 c.cs.	—	15	—	—	—	Sod. Sulphite 1·10, 10 drops	Carmine
	—	—	—	—	—	Tartaric Acid 1·4, 5 to 10 drops	Yellowish Brown
	—	—	—	—	—	—	Yellowish Brown
Hydroquinone 10 gms	10	—	—	—	—	—	Photo. Brown
	—	—	—	—	3	—	Brick Red
Water 1,000 c.cs.	—	—	—	5	—	Gum Solution 10 c.cs.	Gold Tone
Hydroquinone Developer 20 c.cs. Metol do. 20 c.cs.	—	—	5	—	10	Gum Solution 10 c.cs.	Bright Brown
	—	—	—	1	—	—	Yellowish Brown
	—	—	—	1	—	—	Greenish Brown
Pyro 2 gms.	—	5	—	2	—	—	Olive
	—	—	—	—	—	—	Chocolate Brown
Water 1,000 c.cs.	—	1 c.c.	—	2	—	Glacial Acetic Acid 1 c.c.	Dark Reddish Brown
	—	1 c.c.	—	2	—		

—"Bild," Dec., 1905, p. 266.

Developing P.O.P.—H. J. Mallabar has patented a dry-developing mixture for P.O.P., the novelty consisting in the use of a sulphocyanide in conjunction with pyro or pyro and metol, or other mixtures of reducing agents. A minute quantity of potass bichromate may be added; or, in order to keep the plain side of the paper free from stain, potass metabisulphite. The claim for the process is that it converts the free silver nitrate or other soluble silver salt in the P.O.P. into insoluble cyanide of silver. Eng. Pat. No. 13,032, 1905.—"B.J.," Oct. 26, 1906, p. 851.

SELF-TONING PAPERS.

On the invention of self-toning papers see under "History" in Section I.

Self-Toning Emulsions.—C. S. Poulsen prepares self-toning papers by introducing the gold with a dye-stuff such as methyl violet, fuchsine, or the like into an emulsion containing silver, in which the silver is present partly as cyanide or sulphocyanide. Accordingly, to the silver-containing emulsion (collodion, gelatine, albumen, or the like), there is added a dyestuff of the kind referred to, for instance in the proportion of 5—15 milligrams to 1,000 gms. emulsion, and alkaline cyanide or sulphocyanide for instance in the proportion of 3—6 gms., as also gold chloride or the like in such proportions, for instance 2—3 gms., that the gold is present in sufficient degree of concentration in the self-toning paper. The toning—*i.e.*, the reaction in the water or salt bath or like bath—proceeds, as above mentioned, with the employment of the improved paper in a surprisingly short time and with absolute security. According to the proportion of salt in the bath the tone can be varied with exactitude from red-brown to the most extreme blue-black. There is no risk, and no special attention is required in the toning operation. Experience has proved that the principal effect of the dye-stuff is to prevent the reaction between the silver and gold salts while the paper is kept. Such reaction undoubtedly takes place with the self-toning papers hitherto known, and the result is that these papers, as already pointed out, cannot keep. Moreover, the dye-stuff has a favourable influence on the toning. The circumstance that the toning is effected immediately and with a pre-determined tone is, of course, in the first instance due to the presence of the silver-cyanide or -sulphocyanide, but the dye-stuff ensures that the toning is effected evenly and with a uniformly excellent result. Thus, the object of this invention is to provide a self-toning paper which is not only durable, and gives a genuine durable gold tone on dipping in a salt water or like bath, but has also the special property that the gold tone is independent of the duration of the bath, and is determined only by the concentration or composition of the baths so that with a given property of the bath a definite tone will always be obtained without fail, which is instantly formed and does not alter even if remaining a long time in the bath.—English Patent, No. 19,850, 1905.

Ernest Morgan, in a paper before several societies, explains the principles involved in the "Richmond" self-toning P.O.P. ("B.J.A.," 1906, p. 816), in which agar-agar and starch are the vehicles of the sensitive salt. He lays stress (from the point of view of permanence) on the necessity of a paper toning in an alkaline bath. The addition of the soda to the hypo tone-fixing bath prevents any possibility of the bath being decomposed by any little acid which may remain in the coating of the paper after washing, which might decompose the hyposulphite of soda and cause sulphuration of the image. It is very necessary to guard against this danger, as although the decomposed bath would to some extent tone the print even if no gold was contained in the paper, it is a very dangerous and uncertain method

of toning, and generally bleaches the print and yellows and degrades its lights. There is always a considerable amount of free acid in printing-out papers, and unless some precaution of this kind is taken or prints are washed for some considerable time, there is always danger of sulphur-toning occurring, especially when a number of prints have been passed through the fixing bath, and acid from them has accumulated in the bath. The "Richmond" paper will also yield very fine black tones by the use of a very simple supplementary platinum bath. For black tones the prints should be first soaked for five minutes in a bath of 1 oz. of hydrochloric acid to a pint of water, in order to completely convert the free silver of the paper to chloride, and after rinsing in water may be toned by immersing in a bath containing 2 grains of chloroplatinite of potash to each 10 ozs. of water. Prints so treated will tone to a fine black colour in about ten to fifteen minutes, and may then be washed and afterwards fixed in the ordinary hyposulphite of soda bath.—"B.J.," March 16, 1906, p. 206.

COLLODION P.O.P.

Stains, etc., on C.C. Paper.—Harold Baker gives it as his experience of some years back that C.C. prints toned in alkaline gold are remarkably permanent, and bear exposure to sunshine and damp in show-cases in a manner quite surprising. Occasionally prints are spoilt by pale yellow spots, which appear only after they had lain all night in blotting paper. The blotters are sold as chemically pure, and the spots do not appear until the blotting-paper has been in use for some little time. But it is not possible to find out whether the spots are caused by some fungoid growths, such as mould, or mildew, in the paper; or whether chemicals are carried into the blotters by the wet prints. The spots never appear when fresh blotters are used, and as soon as a single spot appears the sheets are discarded. If a print, having the smallest spot escapes detection and is mounted, in a couple of days the spots increase and almost cover the print. I suspected hypo was the cause; but, as the prints were toned, fixed, and washed on the top floor, were drained on a sheet of glass, and then carried downstairs to a room where no hypo was ever used, or even taken into, I could never trace the cause of the trouble. The silver image was bleached to a pale yellow wherever the spots appeared. I never discovered a spotless print go wrong after mounting.—"B.J.," Nov. 10, 1906, p. 897.

H. Matthews finds that whenever yellowish spots appear in the prints after mounting, in ninety-nine cases out of a hundred they are caused by the moisture not being thoroughly dried out of the *interior* of the mounts. When prints are supposed to be dry and are stacked up for spotting, and later placed together in packages, this moisture draws through the mass of mounts so stacked or placed in packages, and carries with it the impurities in the mount, the colouring matter of the mount, or acid generated by damp paste. These various impurities, carried through the prints, attack the image, more often in spots, but sometimes the whole print is affected. The cure for this trouble is easy and absolutely certain. Firstly, never lay prints flat on a table to dry after mounting, but

always place them in a rack so that the air can get to the back as well as the face of the prints. Secondly, when surface-dry, give them the same chances as any other silver prints, and run them through a *hot* burnisher with a thin smooth cardboard to protect the face of the print from the polishing roll. This will heat the mount and thoroughly dry out all moisture from the interior of the same, and will also shape the card much better than a cold burnisher.

Yellow spots can also come from leaving prints in damp blotters, or stacking prints in blotters and leaving them there for some hours, but spots produced in this way are very often much smaller than those caused by moisture in the interior of the mount.

When wishing to dry C.C. prints before mounting, squeegee the water out, lay them out on clean dry blotters, place clean blotters over the face of them, and lay them out to dry. Never place two or more lots of blotters with prints between them on top of each other. The trouble generally comes from piling a number of blotters containing prints on top of each other. The effect of this is that any acids, bleaching chemicals, or hypo in the blotters are released and disseminated through the mass, affecting the prints lying in between. All blotters, after being used, should be hung up by clips on a line to dry before being stacked away for use again.—"B.J.," Nov. 17, 1905, p. 918.

W. Shenton lays stress on the need of (1) the salt solution previous to toning, and (2) thorough washing between toning and fixing:—

I never trust blotting paper, using only clean white cloth, both for drying unmounted prints and for covering when squeegeeing on to the mount. If some light frames are made and covered with well-washed sheeting or muslin in such a way as to be easily detachable for ocasional washing, and the wet unmounted prints laid face downwards thereon, they will dry without curling, and will be found in excellent condition for trimming and mounting.

I never use the double bath for toning, using the platinum bath only, made up with the smallest permissible quantity of acid—citric in preference to nitric or phosphoric—and always mixing the new bath with an equal quantity of an old one. I have found that particles of rubber, which might be used for cleaning mounts, if left on the surface of the print, quickly produce spots of a yellowish colour; but this might not occur with all makes of rubber, being probably due to some solvent used in the manufacture.—"B.J.," Nov. 24, 1905, p. 939.

W. Foster Brigham, writing in reference to a correspondence in the BRITISH JOURNAL OF PHOTOGRAPHY on the permanency of C.C. prints, gives some results of an eight years' experience:

Prints toned in a gold bath only are less permanent than those toned with gold followed by platinum. The former fade after about twelve months.

Red patches, often taking the form of a finger or thumb mark, are due to grease on the surface of the print which prevents the solutions acting. They occur through careless handling, or handling with hot or dirty hands. Only a knack of handling the paper is required for their thorough prevention. To minimise the likelihood of these

marks appearing, after about ten minutes' washing, the prints may be passed through a bath of ¼ oz. bicarbonate of soda to 80 oz. of water. A further washing for five minutes in clean water must follow.

Red spots, other than those caused by grease, seldom occur. If they do, it may be due to iron rust in water, to too little washing before gold, or too strong gold bath.

Bronzing is due to too hard negatives, or to too short immersion in the platinum bath. The single gold toner requires a much less contrasty negative than the double bath.

Blisters appear when the baths are of varying temperatures. In winter the prints are sometimes one mass of tiny blisters. They usually dry down, however, and seldom give further trouble.

White spots appear only on the prints toned in gold only, and may be due to too strong hypo, or the prints have been allowed to lie still in the fixing bath. The prints must be continuously moved.

Cracking is at times a serious source of trouble. It occurs chiefly in cold weather and with fresh batches of paper. Fresh tubes should be opened and allowed to ripen for a few days before use. There is no actual remedy.

Black spots can usually be traced to the use of zinc shapes for cutting oval and circular prints, and are formed by the minute particles of zinc falling on paper before toning. All C.C. prints should be toned before cutting out, not only because of black spots, but because the edges of the prints chip and break off. Be sure that when drying off only the best pure blotting paper is used.

Yellow spots, the bête noir of the collodion printer, arise from many causes, but, unfortunately, unknown causes appear to step in when the former are eliminated. The single gold bath seldom produces these spots, and, therefore, is more reliable, though, not in a way, so permanent, and certainly not capable of producing the black tones that are the chief attraction of the C.C. paper.

The first washing should be thorough. The first toning—preferably in the borax bath—does not have much influence on the production of spots, but the bath should be slightly alkaline. Washing after toning must be thorough, if the spots are to be avoided. Toning in the platinum bath is not to be feared if the previous washing has been well done, but washing after the platinum is absolutely the most important part of the process. Slackness in carrying out this washing is the great cause of spots and fading; the acid from the platinum bath must be eliminated before fixing if permanence is of the slightest importance. To make assurance sure add some borax solution, or carbonate of soda to the last washing water but three.

The fixing bath is seldom advised strong enough by the makers. They recommend 1 oz. to 20 oz. of water, and five minutes' washing, whereas for nearly ten years I have used 4 oz. of hypo to 20 oz. of water, and fixed for a quarter of an hour without the least deterioration.

Be sure that the hypo is alkaline, and, to ensure this, add a few ounces of borax or carbonate of soda solution to it. Also be sure that your hypo is perfectly pure and free from foreign matter. To keep it so, store it so that no impure air can reach it.

Washing after fixing must be of the most ample description. Certainly give ten minutes' hard washing to get rid of the surcharge of hypo immediately after fixing, and wash for at least two hours in running water, or, preferably, give a further half an hour's hard washing. Now dry off on blotting, or on clean sheet for cutting out. It is better to cut out before the prints are bone dry, and to place the cut out prints in water, as the paper when once it has become thoroughly dry is liable to crack and to prove refractory, where sticking flat to mount is concerned. Mount with clear, pure starch, made same day, and lay to dry.

A very frequent cause of yellow spots and cases of fading is the too slow drying of prints. After mounting, the prints must be made bone dry as quickly as possible—if the weather be at all damp the prints must be dried in a heated room. The only satisfactory thing about yellow spots produced by slow drying is that they usually show in the course of twenty-four hours.

Another peculiar feature is that though dampness, if prolonged, has an extraordinary effect on the freshly-mounted print, yet when once dry, damp, or even actual wetting, has no effect. Specimens, first made six or seven years ago, and then exposed in showcases not remarkable for their weather-tightness—in fact, dew frequently soaks the mounts through and through, and this is alternated by strong sunlight—are as good as on the day they were made.—"B.J.," Nov. 10, 1905, p. 885.

Some comments on the changes in the print which may give rise to spots in C.C. prints are made in "B.J.," Nov. 17, 1905, p. 903.

Bromide and Gaslight Papers.

BROMIDE PAPERS.

Acid Developers.—M. Balagny strongly recommends the use of the following developer for all bromide and gaslight papers. Its advantages are that it will not give greenish blacks or greys; it works slowly, and gives pure whites; it can be repeatedly used:—

Sodium sulphite, anhydrous	56 grs.
Amidol	28 grs.
Potassium bromide	14 grs.
Acid bisulphite (com. liq.)	274 minims.
Water	10 ozs.

—"Phot. Gaz.," Feb., 1906, p. 67.

Faults in Bromide Prints.—Namias points out that bromide paper is very liable to alteration exactly in the same way as dry plates, but this is not usually fog, but more often round white spots and marks. From a series of experiments he comes to the conclusion that these are due to the size and the paper. The baryta coating is practically without action, but that prepared with caseine is less reliable than with gelatine. Yellow stains on the prints he ascribes to the use of too weak a fixing bath, which permits traces of the developer to reduce an infinitesimal quantity of silver in the whites. The conclusions he comes to are that saturated, or nearly saturated, solutions of hypo should be used, and there is no need to be afraid

of reduction of density, as this will not appear under two hours. To the hypo solution 5 per cent. of boric acid should be added, which prevents the action of traces of developer. (See under "Fixing" for a note on this point.—Ed.) Fixation should be performed in the dark room, and never in white light.—"Rev. Suisse," Jan., 1906, p. 10.

Quick Printing of Postcards.—W. Foster Brigham recommends that the springs be removed from an ordinary half-plate frame, the hinged back placed in position, and two hinges screwed to the bottom half of the back and parallel to the pair of hinges already in position. The two hinged halves will fall back out of the frame, but are, of course, fixed to it. The frame is screwed up in the dark room one foot from a No. 5 Bray's burner, and the negative and mask, in position, fixed into the frame with gummed paper.

A light-tight box with exposed and unexposed divisions is obtained and sensitive cards unloaded into it. A card is taken out of the unexposed division, placed sensitive side to the negative, and corner up to the guides. The card is held in position at the top, the lower half of the back is raised and pressed against the lower part of the card, this being sufficient to secure it. The hand can then be removed from the top of the card, the upper half of the back raised and placed in contact with the postcard. The two halves are kept in contact with the card and negative by pressing with the hand. The frame being screwed up does not move. The gas is manipulated with the free hand and the exposure given.—"Phot. Scraps," April, 1906; "B.J.," April 13, 1906, p. 287.

Printing Out Silver Bromide Emulsions.—Professor E. Valenta pointed out, before the International Congress of Applied Chemistry, held in Rome, that it is a well-known fact that pure bromide of silver darkens very rapidly in light, but not very intensely, so that it will not assume any intense colour; it is also well known that the blackening of silver bromide takes place much quicker in light, when certain chemical sensitisers are mixed with it. That silver bromide printing paper, prepared in an analogous manner to plain salted paper, has found no practical use should be due to the fact that after fixing the blackness of the image is not satisfactory enough. A series of experiments was carried out for the purpose of studying the behaviour of the same in the print-out process. These experiments, judging from the results, should be practically of importance, as printing papers of very good qualities may be obtained with collodio-bromide of silver emulsion. These papers print very quickly, the sensitiveness is more than double that of any good collodio-chloride paper on the market; they give a very rich scale gradation, and approach in this respect to albumenised paper. The whites of the pictures are very clean, the brilliancy is very satisfactory, and the occurrence of bronzing, which is frequently very troublesome with collodio-chloride papers, has not been met with, even with very strong over-printing. For the preparation of suitable emulsions, calcium, strontium, or lithium bromide, or zinc bromide, which was less satisfactory, were used. The quantities of the bromides are, if vigorous printing emulsions are required, to

be so calculated that about a half of the total quantity of silver should be combined (one can take 18 gms. of silver per litre of emulsion with 2.2—2.5 per cent. of collodion); on the other hand, less citric acid than for a silver chloride emulsion should be used. Yellowish creamy emulsions are obtained which can be very easily and very regularly coated on paper, and which give the above described qualities. These papers print out a purple violet, and the prints assume a yellowish brown colour in the hypo bath. They may be easily toned in the separate and combined baths, and give reddish and purple brown photographic tones; they may also be toned, after preliminary treatment with dilute salt solution, in the combined gold and platinum baths.—"Phot. Korr.," June, 1906, p. 283.

Warm Tones by Development.—Pyro-metol, prepared as follows, will give a range of tones from warm black to red, when the paper is considerably over-exposed:—

A.—Pyrogallic acid	30 grs.
Metol	30 grs.
Sulphite of soda	1 oz.
Bromide of potassium	30 grs.
Water	20 ozs.
B.—Carbonate of soda	3 ozs.
Sulphite of soda	½ oz.
Water	20 ozs.

For use take equal parts of each. With a normal exposure a pleasing warm black tone will be obtained. If development is completed too soon the tones will suffer. The longer the development takes the richer the colour will be, and the better the rendering of the shadow details. The developer should therefore be diluted considerably if the negative shows any indication of flatness. With a plucky negative this precaution will not be so necessary.

The resultant colours depend, to a great extent, upon the amount of the exposure and the quantity of the restrainer and water added. A 10 per cent. solution of bromide of potassium should be kept for the purpose, and the following exposures will approximately indicate the colours obtained.

As an example, we will take a negative of normal density and contrast that requires, say, ten seconds' exposure for black tones with amidol or metol-hydroquinone developer. With fifteen seconds' exposure and the above formula, using 1 oz. of A, 1 oz. of B, and 2 ozs. of water, a warm black tone will be obtained. With twenty seconds' exposure, 4 ozs. of water added to the developer, and 10 minims of bromide solution, the colour will take on an olive tint. With thirty seconds' exposure, 16 ozs. of water, and 30 minims of bromide, a bronze-sepia will be given; while with sixty seconds' exposure (six times the normal), and the developer diluted with 80 ozs. of water and 60 minims of bromide added, a pleasing red colour will be obtained.—"P.N.," Feb. 2, 1906, p. 83.

Henry Maclean has worked out the following table for the pyro formula given above, with the object of assisting in determining the definite recurrence of any given tone obtainable on a constant

make of bromide paper. In the table given it is assumed that ten seconds' exposure with a normal negative is sufficient to give a black colour with a normal amidol or metol-hydroquinone developer.

Exposure	Dilute 1 oz. of Pyro Developer with Water	Add 10 % Bromide of Potash Solution.	Resulting Colour.
15 secs.	2 ozs.		Warm black.
20 secs.	4 ozs.	10 minims.	Warm bronze-black.
25 secs.	8 ozs.	20 minims.	Warm olive.
30 secs.	16 ozs.	30 minims.	Bronze sepia.
40 secs.	30 ozs.	40 minims.	Warm sepia.
50 secs.	60 ozs.	50 minims.	Pinky brown.
60 secs.	80 ozs.	60 minims.	Rusty red.

The time of development increases in proportion to the amount of water added.—"P.N.," April 20, 1906, p. 308.

Invisible bromides, which become visible on exposure to light, are the subject of a French patent (No. 359,218, 1905), of the "Neue Photographische Gesellschaft." The prints are bleached in solutions of copper salt, containing small quantities of sodium, ammonium, or magnesium chloride. The colourless images thus obtained only return to their original form after considerable exposure to light.

Chemical Retouching or Local Reduction.—H. Fourtier suggests the use of the following solution either before or after fixing for cleaning and chemically retouching enlargements:—

Ammonio-chloride of copper, 5 per cent. sol.	10 ccs.
Hypo, 5 per cent. sol.	10 ccs.
Water	20 ccs.

This can be diluted more or less with water, and applied with a tuft of cotton wool. The ammonio-chloride of copper can be made by adding caustic potash to sulphate of copper solution, collecting and washing the precipitate and then dissolving in pure hydrochloric acid.—"Phot. Revue," July 8, 1906, p. 14.

GASLIGHT PAPERS.

Warm Tones.—H. G. Morgan Hobbs recommends imogen sulphite for prints from various classes of negatives, hard and soft. The No. 1 solution is made by dissolving the contents of an ounce bottle in 12 oz. of tepid distilled (or rain) water; while the No. 2 bottle is a saturated solution of common washing soda; each will keep indefinitely in well-corked bottles. One ounce of No. 1 mixed with half the quantity of the soda solution gives the normal developer for plates, but for gaslight papers we add 4½ oz. of water, making 6 oz. of solution in all. Over-exposure, by means of magnesium ribbon, 1 to 1½ inches at four inches from an average negative, gives warm tones with this developer, the image appearing more slowly the greater the over-exposure, and passing through red, orange and sepia to brown, the point at which it attains a proper depth being warmer the greater the exposure. Unlike an over-exposed plate,

which flashes up as soon as the developer touches it, with gaslight paper, the greater the over-exposure, within limits, the slower is the image in appearing, provided the developer is well diluted; secondly, the lighter the colour when it does show; and thirdly, the slower is the process of darkening, amounting in extreme cases to a reluctance to pass beyond the reddish-orange stage.—"P.N.," Jan. 12, 1906, p. 29.

Avoiding Friction Marks.—J. Kendall finds that with addition of a little potass cyanide to the developer friction markings do not appear. He dissolves an ounce of cyanide of potassium in ten ounces of water, and adds from 30 to 60 minims of this to each eight ounces of developer. This is effectual, and it is only in very bad cases of friction marks that the full amount is required.—"St. L. and C. Phot.," Aug., 1906, p. 312.

SULPHIDE TONING OF BROMIDE AND GASLIGHT PRINTS.

Sulphide plus Gold Toning.—At the Photographic Convention at Southampton Messrs. Wellington and Ward showed prints toned by the following method:—After toning by the sulphide process, in the usual way, the print is placed in a sulphocyanide bath of about eight times the usual strength, *e.g.*:—

Ammonium sulphocyanide	20 grs.
Chloride of gold	2 grs.
Water	2 ozs.

In this the prints are immersed till the desired tone is reached, and then washed and dried. The results are fine red brown in colour.—"P.N.," July 20, 1906, p. 575.

[This method was first suggested by A. H. Avery, in "The Photogram," 1904, p. 343.—Eds. "B.J.A."]

Cold Hypo-Alum Toning.—G. E. C. Morris speaks of his preference for this process over all others for toning bromides. He dissolves 5 ozs. hypo in quite boiling water, waits till it has dissolved, and adds ½ oz. alum, stirring all the time. When cool the solution, sediment and all, is bottled, and should always be shaken before use. The prints are placed face down in it, a sheet of glass laid on the top one to keep them down, and the whole left 12, 24, or 48 hours. Uneven toning will not take place if the prints are well washed after development and after fixing.—"A.P.," June 12, 1906, p. 499.

VARIOUS TONING PROCESSES.

Uranium Tones.—C. Welborne Piper, in the course of a correspondence on uranium toning, advocates the use of a very weak toning solution—1 part of uranium nitrate and potass ferricyanide in 3,000 parts of water, on the ground of regularity of action. A better method was found to be one in which the print was first placed in a strong toning bath and toned to a deep full red. It was then washed, placed in weak ammonia until the toning had entirely disappeared, and afterwards retoned in the weak bath. The process was quicker than the other, and more satisfactory in

all ways. With regard to the bad reputation of uranium toning, Mr. Piper states he has found the chief one to be the gradual deepening of red toned prints. These become a brownish red in course of time, but the change is quite uniform and in no way detrimental. The great trouble is a curious grey metallic sheen that appears in the deeper tones. This is often credited to damp and noxious vapour, but he found most unmistakable evidence to the effect that strong light is the prime cause. He also found a cure for the defect and a preventative. The cure is simple india rubber. A sharp-pointed piece of hard pure vulcanised rubber will remove the deposit completely, and a coat of celluloid varnish will prevent its reappearance. It is worth note that this varnish has no visible effect whatever upon the print. It does not give the slightest gloss, and if half a print is varnished it is quite impossible to tell the difference between the two halves when the varnish is dry.—"B.J.," June 15, 1906, p. 478.

M. A. Jonon gives the following rules and method for uranium toning of bromide prints and transparencies. The prints must be full of detail, but not dense, as the toning also intensifies; they must be thoroughly fixed, and it is preferable to pass them through two fixing baths. They must be absolutely free from hypo. The actual toning solution is—

Uranium nitrate	144 grs.	15 gms.
Oxalic acid	115 grs.	12 gms.
Potassium chlorate	24 grs.	2.5 gms.
Potassium ferricyanide	57 grs.	6 gms.
Water to	20 ozs.	1,000 c.cs.

The salts should be separately dissolved in small quantities of the water, and then mixed in the above order. The solution should not be kept more than twenty-four hours. Brown tones are produced, and the prints should be rinsed and dried. (Considering the very doubtful permanency of uranium-toned prints and the far better results obtainable with the sulphide method, this is not a method, no matter how excellent the results, that should be adopted.—ED. B.J.A.)—"Mon. Phot.," Jan. 30, 1906, p. 4.

Copper-Toning Difficulties.—The blistering of bromides during copper toning is found to be preventable by proper precautions in the temperature of the baths. A contributor questions the presence of traces of hypo as the cause of markings on toned bromides.—"B.J.," Mar. 30, 1906, p. 243.

Blue Tones.—The following modification of the ordinary method of toning bromide prints blue is said to give extremely brilliant results. Two stock solutions are required.

A. Potassium ferricyanide	8 parts.
Water	1,000 parts.
B. Ammonia iron alum	10 parts.
Hydrochloric acid	10 parts.
Water	1,000 parts.

For use mix:—

Solution A	100 parts.
Solution B	200 parts.
Water to	1,000 parts.

Vanadium Toning.—C. W. Somerville, writing in reference to failures with the vanadium toning formula for green tones (see formulæ later in this "Almanac"), attributes them chiefly to deterioration of vanadium chloride in solution, and advises that this chemical be kept in solid form, and a piece about the size of a pea dissolved in not more than 20 minims hydrochloric acid.

The vanadium chloride should be in the form of a pasty green substance, and kept in a stoppered bottle in the dark.

An excess of hydrochloric acid has a tendency to bleach the print.

The ferric oxalate must be perfectly pure.

Toning should continue for not less than three minutes, and may be prolonged for six or seven.

Toning and washing should preferably be performed in daylight, or may be done in incandescent gaslight, but should not be done in yellow gaslight or incandescent electric light, as it is impossible to judge the appearance of the green in a yellow light.

Gaslight papers tone very much quicker, and give a very much poorer tone than bromide. This also applies to all forms of toning solutions.

Wash in either slowly running water or frequent changes.

Washing is prolonged by the fact that the stain from the potassium ferricyanide must be eliminated, but a solution of potass. citrate almost completely removes stain.—"Pgm.," Sept., 1906, p. 265.

Toning Bromides.—The following formulæ are given by Dr. Sedlaczek for toning bromide prints, in his work "Die Tonungsverfahren von Entwicklungspapieren. (Halle: W. Knapp.)

DEEP BROWN TONES.

Uranium nitrate, 10 per cent. sol.	50	minims.
Potassium ferricyanide, 10 per cent. sol.	20	,,
Potassium oxalate, 10 per cent. sol.	50	,,
Hydrochloric acid, 10 per cent. sol.	10	,,
Water to	2	oz.

WARM BROWN TONES.

Uranium nitrate, 10 per cent. sol.	50	minims.
Potassium ferricyanide, 10 per cent. sol.	20	,,
Potassium oxalate, 10 per cent. sol.	50	,,
Ammonia alum, sat. sol.	100	,,
Hydrochloric acid, 10 per cent. sol.	3	,,
Water to	2	oz.

BROWN TONES.

Uranium nitrate, 10 per cent. sol.	50	minims.
Potassium ferricyanide, 10 per cent. sol.	20	,,
Rochelle salts, 10 per cent. sol.	70	,,
Tartaric acid, 10 per cent. sol.	10	,,
Water to	2	oz.

Reddish Brown Tones.

Uranium nitrate, 10 per cent. sol.	50 minims.
Potassium ferricyanide, 10 per cent. sol.	20 ,,
Rochelle salts, 10 per cent. sol.	50 ,,
Ammonia alum, sat. sol.	100 ,,
Tartaric acid, 10 per cent. sol.	50 ,,
Water to	2 oz.

It is not advisable to use the baths too long or for too great an area of paper: 3½ oz. should suffice for about 700 square inches.

If the prints, no matter what bath they are toned in, are treated for five minutes to

Sodium sulphide	2½ grains.
Hydrochloric acid	1 minim.
Water	2 oz.

they assume a deep brown tone, and will keep for at least four years without any change or bronzing in the shadows.

Deep Blue Tone.

Ammonia iron alum, 10 per cent. sol.	12.5 minims.
Potassium ferricyanide, 10 per cent. sol.	10 ,,
Potassium citrate, 10 per cent. sol.	10 ,,
Ammonia alum, sat. sol.	50 ,,
Hydrochloric acid, 10 per cent. sol.	2.5 ,,
Water	1 oz.

The citrate of potash may be replaced by 3 minims of saturated solution of oxalic acid.

Cold Blue Tone.

Ammonia alum, 10 per cent. sol.	50 minims.
Potassium ferricyanide, 10 per cent. sol.	10 ,,
Potassium oxalate, 10 per cent. sol.	30 ,,
Ammonia iron alum, 10 per cent. sol.	12.5 ,,
Hydrochloric acid, 10 per cent. sol.	2.5 ,,
Water	1 oz.

In place of the oxalate, 15 minims of a 10 per cent. solution of Rochelle salts may be used.

Grey Blue Tone.

The same bath as the last, but with 5 minims of a 10 per cent. solution of tartaric acid instead of the alum, and without the hydrochloric acid.

Bright Blue Tone.

Ammonia iron alum, 10 per cent. sol.	50 minims.
Potassium bromide, 10 per cent. sol.	30 ,,
Hydrochloric acid, 10 per cent. sol.	5 ,,
Water	1 oz.

By treating prints toned in the above baths with a .01 per cent. solution of carbonate of soda or ammonia, reddish-violet tints are obtained, and greenish-blue to green tones by immersing them in:—

Sodium sulphide, 10 per cent. sol.	0.5	minim.
Hydrochloric acid	0.5	,,
Water	1	oz.

Care must be taken not to leave the prints too long in this, or they will turn black.

RED TONES WITH A BROWN TINGE.

Potassium citrate, 10 per cent. sol.	150	minims.
Copper sulphate, 10 per cent. sol.	24	,,
Potassium ferricyanide, 10 per cent. sol.	18	,,
Ammonia alum, sat. sol.	60	,,
Water	1	oz.

BRICK-RED TONES.

Potassium citrate, 10 per cent. sol.	75	minims.
Copper sulphate, 10 per cent. sol.	24	,,
Potassium ferricyanide, 10 per cent. sol.	18	,,
Ammonium carbonate, 10 per cent. sol.	6	,,
Water	1	oz.

This bath has a tendency to give double tones, that is, the deep shadows show a blackish tinge. A very beautiful cherry-red tint with a violet shade is obtained by replacing the citrate solution in above bath with quarter-ounce of 10 per cent. solution of ammonium oxalate, but the whites are often tinged.

RED-BROWN TONES.

Potassium oxalate, 10 per cent. sol.	60	minims.
Copper sulphate, 10 per cent. sol.	24	,,
Potassium ferricyanide, 10 per cent. sol.	18	,,
Tartaric acid, 10 per cent. sol.	6	,,
Water	1	oz.

A faint tinge is imparted to the whites by this bath. If the tartaric acid is replaced by acetic acid a browner tone is obtained. If the quantity of oxalate is doubled, and 60 minims of alum sat. sol. added to the above, a purer brown is obtained with tinged whites, which give the effect almost of toned papers.

COPPERY-RED TONES.

Ammonium oxalate, 10 per cent. sol.	120	minims.
Copper sulphate, 10 per cent. sol.	24	,,
Potassium ferricyanide, 10 per cent. sol.	18	,,
Oxalic acid, sat. sol.	6	,,
Water	1	oz.

This gives a slight tinge to the whites.

A mixture of a ferricyanide and an alkaline halide produces instant conversion of the image into the corresponding silver halide. Such solutions can be kept as stock solutions; they do not reduce the image, nor attack the gelatine.

The bleaching bath for the print, which should be previously well soaked in water, should be:—

Potassium ferricyanide	6 grains.
Potassium bromide	2½ ,,
Water	1 oz.

The image bleaches instantly, and should then be well washed and treated with the sulphuretted hydrogen bath (see the acidulated sodium sulphide bath given above), or ammonium sulphide or sodium sulphide, and for the latter the bath should be:—

Sodium sulphide	50 grains.
Sodium sulphite	50 ,,
Water	1 oz.

For use, one part of this should be diluted with nine parts of water.

A 1 per cent. solution of Schlippe's salt gives reddish-brown tones, which are redder than the bromised prints thus treated. A red brown is also obtained by using:—

Uranium nitrate	18 grains.
Potassium bromide	9 ,,
Water	1 oz.

Blue tones are obtained by treatment with:—

Ammonia iron alum	12 grains.
Potassium bromide	6 ,,
Hydrochloric acid	2 minims.
Water	1 oz.

If in this bath the whites turn yellow, they should be well washed with a 0.3 per cent. solution of hydrochloric acid.

Toning with Mercury Salts.

In this, as already pointed out, the image is bleached with a mercury compound, and the bath should be:—

Mercuric chloride	6 grains.
Potassium bromide	6 ,,
Water	1 oz.

When thoroughly bleached, wash well, and then treat with the following solutions to obtain the various colours:—

Greyish black, a 1 per cent. solution of hypo.

Greyish violet, immerse in:—

Hypo	5 grains.
Acid sulphite of soda	2½ ,,
Water	1 oz.

Brown to violet black:—

Hypo	9 grains.
Copper sulphate	9 ,,
Water	1 oz.

If to the above a drop or two of a 10 per cent solution of sodium carbonate be added, the tones are darker.

Brownish violet:—

Hypo	6 grains.
Silver nitrate	2 ,,
Acid sulphite of soda	3 ,,
Water	1 oz.

Blackish-violet:—Treat the print with a 1 per cent. solution of acid sulphite of soda.—"B.J.," Aug. 10 and 17, 1906, pp. 624, 645.

The Carbon Process.

Bichromated Gelatine.—Lumière and Seyewetz, continuing their researches have investigated the insolubilisation of the bichromated gelatine in the dark. The conclusions they come to are that it contains much less sesquioxide of chromium than that which is rendered insoluble by the action of light, and that the quantity of this salt increases very slowly, for after one month it amounted to only 0.67 per cent., and 1.15 per cent. after six weeks, whilst after a few hours exposure to light it amounted to over 5 per cent. Further, bichromated gelatine, which becomes insoluble in the dark, does not, even after 4½ months, completely withstand the action of hot water. If the bichromated gelatine is kept at 120 degrees C., boiling water will no longer attack it, but the gelatine becomes disintegrated and breaks up into small particles, which will pass through a filter.—"Phot. Woch," Jan. 2, 1906, p. 2.

Increasing the Sensitiveness of Bichromated Gelatine.—Although MM. Calmels and Clerc have advanced the statement that the sensitiveness of bichromated gelatine, fish glue, and albumen can be increased by the addition of some dyes, such as eosine and erythrosine, as used in dry-plate work, this has been denied by Tchörner; and now Dr. Neuhauss has been carrying out experiments on the same lines, and finds that no increase in sensitiveness can be obtained by this means.—"B. J.," Dec. 8, 1905, p. 969.

Acetone Sensitising Solution.—The Actien Gesellschaft für Actien Fabrikation has patented a sensitising solution of potass. bichromate containing acetone, the presence of which is to cause rapid drying of the tissue. It is prepared and used in such a way as the two folowing:—(1) 8 parts of ammonium bichromate are dissolved in 100 parts (by weight) of water, and this solution is mixed with 150 parts (by weight) of acetone. This liquid is applied for the purpose of sensitising a carbon tissue by spreading it over the tissue by means of wadding. After 5—10 minutes, according to the moisture of the atmosphere, the tissue is dry and is exposed to light under the negative, a print from which is to be made as usual. (2) For sensitising, for instance, a paper covered with a layer of gum incorporated with a pigment, as in the gum-bichromate process, there may be used a mixture of 2 parts of potassium bichromate, dissolved in 40 parts of water, with 60 parts of acetone. The sensitising process is then carried out by applying this solution to the layer either by means of a suitable brush or by plunging the paper into the solution. In the latter case the tissue will dry in ¾—1 hour. —Eng. Pat., No. 9,324, 1905; "B.J.," Dec. 22, 1905, p. 1012.

To arrest the continuating action of light, Ernest Marriage desensitises the printed tissue by giving it a few soaks in water and then

dries it, developing at any later convenient time. It was found that such desensitised tissue can be dried in daylight, and after storage for a month in an ordinary drawer can then be squeegeed down and developed perfectly satisfactorily.—"A.P.," Nov. 7, 1905.

Bühler's Non-transfer Carbon Process.—For a direct-development pigment paper Emil Bühler has patented a mixture of emulsified casein and soap. If the materials are emulsified in a suitable manner and mixed with the required pigment and gum arbic an emulsion is obtained which can be poured on to a support of gelatine, and will become sensitive to light in a solution of bichromate of potassium in such a manner that on subsequent exposure to light, the parts acted on by light are rendered insoluble in warm water. The excess of colouring substance is then removed by washing with water, and the picture is developed. This vehicle of the pigment, which does not combine so intimately with the latter as gelatine, gives a different appearance to the print. The print has no homogenous surface, but appears granular in a strong light and irregular. In the deeper shadow where the effect of light was stronger, the grain decreases, however, and disappears in the deepest shadow. This grain—i.e., perfectly white spaces adjacent to the black pigment—gives a highly plastic effect to the picture, which has not been obtained in any other manner, and is a characteristic feature of the vehicle.—Eng. Pat., No. 12,867, 1906; "B.J.," Mar. 9, 1906, p. 195.

The paper is first immersed in methylated spirit for a minute, then sensitised in a 2 per cent. solution of potassium bichromate, and dried. The paper must be exposed till the details are distinctly seen of a brown colour in the high lights when examined by transmitted light; practically, one must print about twice as long as with P.O.P. After printing, the tissue should be immersed in cold water for a minute or two, and then in water at about 100 deg. Fahr., in which the print will develop slightly, and must then be sprayed with a fairly strong, but fine, stream of cold water. It is stated by Professor Schmidt, of Karlsruhe, that there is much greater transparency in the shadows than usual, and that the paper will give two grains—one coarse for large work, and the other fine for small.—"D. Phot. Zeit.," June 22, 1906, p. 433.

[Casein, it will be remembered, was patented by Johnson in 1870 for pigment printing. Pat. No. 201.—Ed. "B.J.A."]

Pigment Tissue with Silver Bromide.—Riebensahn and Posseldt took out a patent last year for making carbon tissue with an admixture of silver bromide. In a more recent patent they point out that the rapidity of the bromide is considerably reduced, by the pigment, probably, through the screening action, and propose to get over the difficulty by using the dyes generally used in the orthochromatising of plates, such as eosine, erythrosine, ethyl red, etc.—Ger. Pat., No. 158,517, April 21, 1904.

Multiple Carbon Printing.—Nelson K. Cherrill employs his patented printing frame (as made by Houghtons) for transferring several carbon prints in register on to the same final support, developing each in turn before the next is added. To do this

the "temporary support" (in double transfer work) must be fixed to a rigid foundation, which can be provided with two pins corresponding to those on the printing frame. Practically, this may be done by cementing a piece of "flexible support" to a zinc plate with insoluble paste, as per formula in "Photography," Dec. 26, 1905. (See under "Multiple Gum" on another page.—Ed. "B.J.A.") Two brass pins inserted near the edge of the plate give the necessary register. The tissue is held during printing, and until the moment of transfer on a carrier, formed of a piece of thin sheet zinc provided with the usual notch for register, and perforated near the centre by a rectangular aperture. For all small sizes, say up to 7in. by 5in., this aperture may be about 3in. by 2in.

The tissue is temporarily fastened to the carrier by two strips of gum paper, such as stamp edging. The easy way to do this is to place the tissue in place on the negative, then to fit the carrier in register with the pins, and then to apply two strips of gum paper at opposite edges of the rectangular opening. When the printing is finished, the transfer is made by plunging the transfer plate into a deep dish of cold water, and then placing the carrier with the tissue attached, exposed side downwards, also into the water. The register is secured by the pins on the transfer plate being made to engage with the notch and straight edge of the carrier at the moment of squeegeeing. The squeegee is applied first over the rectangular opening in the camera. Then the gum paper joints can be torn—being wet they will tear with great ease—and the carrier removed; directly this is done the squeegee should be again applied, working lightly from the centre in all directions. After development in the usual way, the print should be alumed, rinsed, and set up to dry. When, however, a second image is to be superposed, it is not necessary to wait for the first to become quite dry. If the surface moisture has disappeared, that is all that is necessary, and the plate may then be at once plunged in cold water to receive another piece of exposed tissue transferred to it in the same manner as the first.

It will be seen that the maximum error in registration between any two superposed images from the same negative will amount to the difference of expansion which takes place during the soaking of the two pieces of tissue. By timing with a watch, and so equalising the soaking, the error arising from this cause will be so slight as to be a negligible quantity. I find forty-five to sixty seconds the best time for soaking. This is found quite enough if the plate be kept under pressure for ten minutes before development.

When all is finished, the transfer to final support is effected in the usual manner. If it be desired to work in this same way, but with single transfer, the only difference in the proceeding is that in place of the flexible support laid down permanently on the transfer plate, a piece of single transfer paper must be mounted temporarily thereupon. It should be mentioned that the "flexible support" once laid down on zinc, as described, lasts for an indefinite number of prints, and that it is very much more convenient to use in this form than in its original "flexible" condition.—"Phot.," April 24, 1906, p. 327.

Printing from Relief Prints.—A patent derived from the catatype principle has been taken out by the Neue Photographische Gesellschaft, Berlin. It is based on the power of a gelatine relief to retain a volatile substance—*e.g.*, hydrogen peroxide dissolved in ether. If a gelatine relief be flooded with such a solution, the latter volatilises in proportion to the depth of the gelatine in the different parts of the picture; the residual peroxide is "developed," —*e.g.*, with a manganese salt, which forms with it an image of peroxide of manganese.—Eng. Pat. No. 996, 1906; "B.J.," Sept. 21, 1906, p. 754.

THE OZOBROME PROCESS.

(Carbon Prints from Bromides.)

The patented invention of Thos. Manly provides for the production of pigment prints through the action of a (treated) bromide print on a pigmented and bichromated gelatine tissue. The three claims for the process (which is called "Ozobrome" by its inventor) are:—1 A bath for use in photographic printing in pigmented gelatine or other colloid or mucilaginous substances, from a metallic silver image produced by development, consisting of (*a*) Potassium or other alkali bichromate; (*b*) Potassium or other alkali ferricyanide; (*c*) Potassium or other alkali bromide, or one or more of the soluble haloid salts of an alkali; (*d*) Water. 2. The improved method of producing pictures in insoluble gelatine or other colloid which consists in impregnating a gelatine or other colloid surface on a suitable support with a solution as claimed in (1), to which may be added alum and citric acid, placing in contact with the gelatine or other colloid surface a metallic silver image produced by development on any support separating the two supports, and washing the gelatine or other colloid surface, whether adhering to the metallic silver image or to its original support, or whether it has been transferred to another support. (3) The process of producing a picture in pigmented gum by mixing a concentrated solution of the bath claimed in (1) with a solution of pigmented gum, and spreading the same in the metallic silver print produced by development. The solution in which the tissue is soaked is called the "pigmenting solution" by the patentee, who directs its use as follows:—I soak a piece of paper, coated with pigmented gelatine, otherwise called carbon tissue or pigment plaster, in the pigmenting bath until it becomes saturated. In the meantime I place a bromide print or other image consisting of metallic silver in a dish of cold water. As soon as the pigment plaster in the pigmenting bath has become limp or saturated, I withdraw it from the bath and place it face upwards upon a glass plate. I now take the bromide print or other image, consisting of metallic silver from the dish of water, and place it carefully upon the pigment plaster lying upon the glass plate, and squeegee the two papers into contact. I then place the combined papers upon blotting paper until ready for development. Up to this point the method of producing a pigmented picture upon the original silver print, and an impression for transfer upon another support, is the same. After the squeegeed papers have been in contact about 20 or 30 minutes the image of the silver print will have acted upon the film of the pigmented gelatine and

the two papers will require to be separated. There are two methods of separating these papers; according to the first, when the original silver print is intended to be the support of the picture, the adhering papers are soaked in hot water and separated, and the development takes place by washing away from the silver print all the pigmented gelatine adhering thereto that has not been rendered insoluble by the action of the metallic silver. The black silver of the print will have become a faint brown in the operation.

According to the second method, when it is desired to transfer the gelatine impression to another support, then the two adhering papers are plunged into cold water and separated by slowly and firmly pulling them asunder. In this case the pigmented gelatine film remains on its support, and holds an impression of the silver image, and may be squeegeed down upon a fresh support and developed by removing the original support, washing away the soluble gelatine and leaving the picture on the fresh support. The silver print may then be washed and re-developed by any of the usual developers for bromide prints, and again washed, when it will serve for the production of another pigment print by being treated according to the second method above described. In this manner several transfer prints can be obtained from one metallic silver print produced by development. Of course, a redeveloped silver print can be treated as described in the first method, and a pigmented picture produced upon the original support. Photographic negatives may be intensified and lantern slides may be coloured by adopting the first method hereinbefore described. Pictures in pigmented gum can be produced by mixing a concentrated solution of the above-mentioned bath with a solution of pigmented gum, which is spread on the metallic silver print with a brush or otherwise. The results obtained by my invention are not due to any catalytic action, but can be traced to chemical decomposition, thus :—

$$2Ag + 2(K_3FeCy_6) + 2H_2O = \left\{\begin{matrix} Ag_3FeCy_6 \\ K_4FeCy_6 \end{matrix}\right\} + 2KHO + 2H.$$

$$Ag + KBr + H_2O = AgBr + KHO + H.$$

The H and K_4FeCy_6 reduce the bichromate salt producing insolubility of the gelatine, and as these two products are strong reducers and are not soluble, they can be made to penetrate the film to any desired depth, thus securing rich pictures with perfect gradation.—Eng. Pat. No. 17,007, 1905; "B.J.," June 29, 1906, p. 513.

E. W. Foxlee contributes an article on the process to the "B.J." of July 6, 1906, p. 524.

Some further notes, embodying the information in the patent specification, appear in "Phot.," Aug. 7, 1906, p. 106.

Rev. Henry W. Dick finds it advisable to depart from the instructions for working ozobrome by the first method (that in which the final print consists of the carbon image on the bleached bromide). His departure, which aims at intensifying a weak print, is to redevelop the bleached image or to tone it with sulphide—in order to obtain a black or sepia print—instead of dissolving the bleached

image away with Farmer's reducer, as directed by the makers. In the case of redevelopment, the increase of density can, if too great, be corrected with Farmer's reducer.

Mr. Dick also employs the process as a corrective of tones in a bromide print, using it to increase the depth of shadows. For this purpose the two prints are left together for long enough only to permit of the impregnated pigment plaster acting on the shadows of the bromide, say, five minutes instead of twenty.

In this case the bromide print will be found upon developing to be bleached out, and it will be seen that patches of gelatine and pigment stand up in relief upon the shadows only. Now, if after washing the silver image is redeveloped, the high-lights and half-tones will come up as before, but the shadows are much deeper.—"A.P.," Aug. 28, 1906, p. 188.

"Practicus" cautions the worker to use a piece of pigment plaster larger than the bromide print as a preventive of frilling.

It is found, also, that P.O.P. prints (solio) are amenable to the ozobrome process.—"Phot.," Sept. 4, 1906, p. 193.

H. W. Dick, in a demonstration before the North Middlesex Society, dealt with practical details of Ozobrome:—

The stronger the "pigmenting bath," the quicker the transfer of the picture.

The contact between the prints and the tissue is only of service while the two are wet. If the time is so long that the tissue or the bromide print dries, the action comes to a stop.

In preparing Ozobromes from flat prints it is an advantage to add a little alum to the "pigmenting bath," but, according to Mr. Manly, potass. citrate is preferable for this purpose.—"B.J.," Oct. 5, 1906, p. 785.

Some other notes dealing with the process are published as the report of a lecture by the Rev. W. H. W. Dick in London, "B.J.," Oct. 5, 1906, p. 785, where also the following additional instructions are given by the makers:—

In Method No. 1, the bromide picture should be printed with a white margin of about half inch all round to serve the purpose of a safe edge, so as to prevent the edges of the picture from frilling during development.

In contact printing the margin formed by the rebate of the printing frame is generally sufficient, but in making enlargements the margin of the bromide paper should be protected. This may be easily effected in the following manner:—

Take a sheet of cardboard the size of the bromide paper (the strawboard packed with the sensitive paper will answer admirably), paste or glue strips of thin cardboard or stout paper of any colour along each edge of the card, allowing about half an inch of the paper to project from the edge. When dry, turn the half-inch edge over the card, so as to form a kind of sheath, such as is used for carrying plates in some magazine hand cameras, but, of course, with four edges protected. You have now a very handy contrivance, which will be always serviceable. When about to expose, slide the sensitive paper into the sheath by unbending one side and replacing it. Adjust on the easel by pinning through the card.

In Method I., the bleached image beneath the carbon picture may be redeveloped partially or entirely, and this may be made use of in various ways. For instance, a weak bromide may be converted into a strong print by re-blackening the underneath image, and many beautiful effects may be secured by causing the redeveloped silver to modify the tone of the semi-transparent carbon picture.

If a weak developer be applied with a brush, local intensification may be effected, and a sky which is hardly strong enough for the rest of the picture may be made heavier in this way.

The underlying image may also be toned by the various bromide toning solutions.

Of course, the developing or toning solutions must be removed by washing for about fifteen minutes.

The redeveloped silver image, being protected from the atmosphere by a layer of hardened gelatine, is naturally much more permanent than an ordinary bromide print.

Gum-Bichromate.

Unstable Gum Prints.—Harold Holcroft records his experience of the change in colour and effect undergone by some gum prints in the course of time. He discusses the causes of such instability in gum prints—viz. :

A portion of the image consists of light affected gum-bichromate, which part of the image bleaches on exposure to light. To free the print from this cause of impermanency this gum image should be bleached out by soaking in a semi-saturated solution of alum for half an hour after development—the print having been dried before going into the alum. The print is then exposed to strong daylight for a week or two, to complete bleaching.—"Pgm.," Oct., 1906, p. 300.

To Standardize the Coating Mixture.—T. H. Greenall prepares gum solution of definite constant strength, and adds the bichromate as a fine powder and the pigments as standard mixtures of gum solution and moist pigment. Thus for a coating mixture :—Gum solution, 4 drachms ; pigment cream, 20 minims ; potass bichromate, 12 grains.—"A.P.," June 5, 1906, p. 476.

H. D'Arcy Power aims at securing details and gradation in gum prints by the following method of working :—The pigments are kept mixed with water in such proportions that when mixed with an equal quantity of gum solution they are ready for spreading. This varies with different pigments, but in the case of process black it is one to four. The gum solution is of the usual 40 per cent. In a box is kept a quantity of ammonium bichromate made up into ten-grain powders.

When coating the paper all that has to be done is to shake the bottle of pigment and water, pour out a drachm, add a ten-grain powder and a drachm of gum solution, stir, and the coating mixture is ready. To modify the tint the necessary colours are mixed in water until the required tint is obtained, and in doing so there is not the disturbing presence of the yellow chromate. After

measuring off the required quantity, we proceed as before. In this way perfectly uniform results may be obtained without any sacrifice of the liberty to modify at will.

To obtain the greatest detail and the longest scale of gradation, exposure should be rather over than under the normal, and the development effected by floating on cold water until the half-tones in the lights are fully out. The print is hung up to dry until it is in a condition of tackiness (only to be learned by experience) when gross modifications or eliminations may readily be made. In this way backgrounds may be generalised, and obtrusive high lights and so forth spotted out. After the print is dry (it must not be made bone dry), it is again soaked in water, and the shadow detail brought out by brush development, and such alterations in the values effected as may be necessary.

By proceeding in this way, the detail in the high-lights is equally preserved with that in the shadows, the scale of gradation is fully maintained, and none of the essential advantages of the gum process are sacrificed.—"Phot.," Feb. 20, 1906, p. 155.

Enlargements Direct on Gum-bichromate Paper.—Dr. R. Hiecke, in making enlargements on gum paper from sets of three-colour negatives, has found that a general supplementary exposure of the gum paper permits of the exposure being greatly reduced. The enlarged image was projected by an ordinary lantern fitted with an arc lamp of twelve ampères. An ordinary double condenser of 4in. diameter was used, with a Steinheil antiplanat of 7in. focus at *f*/5.

The three negatives of the tricolour set which were used for the experiment were clean and almost hard; the size of the enlargement was 2.8 times linear. The paper used was Schöller-Hammer paper sized with chrome-alum-gelatine, according to Kosel's formula. The pigment mixture consisted of one-part of gum solution (60 parts of gum arabic in 100 of water) and two parts of a 10 per cent. solution of potassium bichromate, with the requisite quantities of tube colours.

The exposure required for each of the three colours was about twenty minutes. The prints gave, however, as was only to be expected in gum-bichromate, only a few of the lightest gradations of the negative, so that to obtain a perfect three-colour print, at least six exposures, each of twenty minutes, or two hours' exposure in all, were required. It became necessary, therefore, to try and obtain a reduction of the exposure. Here the author happened on a process which not only solved this question, but also had the further advantage that it reduced the number of printings to one for each colour.

The process consists of illuminating during exposure the sensitive paper on which the negative is projected by a supplementary light of even strength over the whole of the surface. The action of this supplementary lighting ought naturally not to go so far that the high-lights remain coloured during development; the limits here laid down, however, are fairly wide in consequence of the variation in the duration and forcing of the development. By this supplemental lighting the exposure on the

one hand is considerably reduced, and on the other hand the number of gradations of the negative projected can be increased at will, so that the softness of the prints is under control.

The supplemental exposure was given by means of two incandescent lamps of 35 NK. at 100 volts, which, however, run at 110 volts, gave 75 NK. The two lamps were placed one on each side of the screen at a distance of 18in.; to increase their action a semicylindrical reflector covered with white paper was used. The other arrangements were as already described. With this supplemental illumination much softer prints were obtained and a reduction of the exposure for the red and yellow prints to 15 minutes, and for the blue to 10 minutes, was obtained.

Still even now the extreme reduction of the exposure is not reached. If the bichromated gum solution is allowed to stand for some time in the dark it becomes considerably more sensitive. The sensitised pigment and gum solution had, for instance, after seventy hours, about three times its original sensitiveness, so that with the supplemental exposure the yellow print only required 5½ minutes to give an image equal in quality to that obtained with a fresh solution of gum in 15 minutes.

It is important to point out that the coating of colour must not be dried by heat before printing. A small electric fan is used. After development, however, each individual print should be dried by heat, and then where possible be well exposed quite close to an arc lamp, so as to make sure that the gum is quite insoluble and thus be able to bear the coating and distributing brushes. It was soon found that in quick work this was not attained by cold drying. Development was always effected with a rose.—"Phot. Korr.," April, 1906, p. 170; "B.J.," April 20, 1906, p. 305.

MM. Demachy and Puyo have written a complete treatise on the pigment processes—gum, gum-ozotype, oil printing, etc.—from the pictorial workers' standpoint. ("Les Procédés d'Art en Photographie." By R. Demachy and C. Puyo. Paris: The "Photo-Club." 12fr.)

J. Cruwys Richards contributes a series of chapters on gum methods to "Focus" of March 21, 28, etc.

The Foxlee gum process, in which the image on one bichromated film is transferred to a film of a different unbichromated colloid, was the subject of a lecture by E. H. Griffin.—"B.J.," Jan. 26, 1906, p. 67.

Mr. Foxlee adds some further notes on the subject.—"B.J.," Feb. 2, 1906, p. 89.

MULTIPLE GUM.

Paper Expansion and Gum-bichromate.—G. O. Smith, also writing as to the results of E. J. Spitta (see Sect. II.), explains his method of avoiding trouble from this cause in multiple-gum work. His printing frame is a small board, made like a drawing board to prevent warping, size 11½in. by 9½in., for whole-plate. Three smooth pins are firmly fixed into this board as a guide for registration, two being at an interval of six inches apart along the long side of the

whole-plate, and the third in the centre of one of the ends. By placing a negative against the two pins and sliding it along, taking care that it is in contact with both of them, until it is stopped by the third, one can make quite sure each time it is put down that it goes into exactly the same place. A sheet of stout zinc, also whole-plate size, forms the basis of the print. The zinc is slightly roughened with a piece of fine glass paper, and has a coating of rubber solution, similar to that sold for repairing pneumatic tyres, and while this is tacky a piece of "American plaster" is cemented down on it, sticky side outwards. The plaster is a kind of cloth, coated with a very similar preparation, which remins tacky for a long time. The paper is stuck to the cloth.

Blisters forming between the paper and the zinc plate, as soon as the paper is wetted, are avoided by taking care that the paper is in a state of tension when stuck down. To effect this a sheet of paper 10in. by 8in. is soaked in water, blotted off, and glued by its edges to a little wooden frame its own size. It dries as tight as a drum, and is rubbed down into contact with the zinc plate, while it is still stretched on the frame. It only remains to run a knife round the plate to obtain a smooth paper surface, that can be wetted and dried, coated with gum and bichromate, developed, alumed, recoated, etc., many times without the slightest fear of bad registration. The plate is pushed up to the pins in exactly the same way as the negative.

The print when finished can be pulled off the plaster without any trouble, leaving the sticky surface ready to receive a fresh piece. Of course, it must not be removed from the plate until all the printing operations are finished.—"Phot.," Jan. 2, 1906, p. 17.

Nelson K. Cherrill, in refrence to Mr. Spitta's results in the contraction of paper (see earlier in this "Epitome") points out that if paper be made to contract in drying under a definite strain, it will accommodate itself to the conditions imposed upon it, and, however many times it may be wetted, it will always, if submitted to the same strain, return in drying to the same size.

In multiple-gum printing this principle is applied in the following manner:—The paper to be printed upon is stretched on a flat plate of rolled zinc, about 3-64in. in thickness. The paper, which must be considerably larger than the zinc plate, should be soaked in water till it is quite limp—hard papers need half an hour's soaking. When thoroughly soaked, the paper is laid down on a clean surface and the zinc plate placed on it in the middle. The corners of the paper are then cut away diagonally, after which the ends of the paper are pasted over on to the back of the zinc plate. A useful insoluble paste for the purpose is made as follows:—

Arrowroot or starch	5 gms.	} Boil.
Water	65 ccs.	

then add 10 ccs. of a two and a half per cent. solution of chrome alum. When dry it will be found that the paper is stretched as tight as a drum.

On a surface of paper so prepared a gum print can be made in as many printings as may be desired. If it be wetted twice or

twenty times it will always dry out flat and tight. If a notch be cut in the zinc—the paper being cleared away just at that part—the printing can be done in one of the "Cherrill" frames, in which case the superposed images of many successive printings will be so exactly in register that the finest detail may be rendered without blurring.

Dr. Spitta's paper suggests that gum-bichromate, worked in this way, would probably give a very accurate result of the kind he was aiming at. In order to test this, a scale was made by scratching very fine lines with a needle on an old negative. This was printed by gum-bichromate on a piece of ordinary writing paper, stretched, as described, on a plate of glass. When the print was dried, its dimensions were absolutely identical with those of the original negative, and they remained so after cutting the print from the glass.

As, however, paper expands or contracts, according to its hygrometric condition, a note must be made on each print of the exact humidity of the atmosphere at the time of its being cut off the glass, and this condition of humidity must be reproduced to a nicety when an important measure is to be taken if accuracy is required.—"Phot.," Dec. 26, 1905, p. 526.

THE OIL PROCESS.

M. Demachy has worked out improvements in the oil process of Rawlins as described originally in the A.P., of October, 1904. He has quite abandoned Mr. Rawlins' method of sensitising (immersion in a 10 per cent. acid bath of potassium bichromate). The gelatine takes hours to dry; the paper, soaked right through with chromic solution, requires a long and thorough washing; and in summer the gelatine, unless the bath is cooled down with ice, will become dangerously soft. Instead of this he uses the following method:—

Make a stock solution of:

Water	100 ccs.
Ammonium bichromate	5 gms.
Carbonate of soda	0.5 ccs.

For use, take 5 cubic centimetres of this solution, and add 10 cubic centimetres of alcohol of 90 degrees. Pin your gelatine paper on a sheet of thick blotter fixed to a drawing board, and brush the gelatine side of paper right and left with a two-inch wide flat brush of hogs' hair dipped in the alcoholic solution. Fifteen ccs. will cover five whole plate sheets. A few parallel lines may remain on the film just after sensitising, but they will disappear in the course of drying. Dessication will be completed in fifteen minutes at the most, a formidable gain of time on the previous method. Also, the gelatine having alone absorbed the sensitising solution, the elimination of the chromic salts will be much easier than when both gelatine and paper have been impregnated. After a few minutes' washing, the yellow tint of the bichromate will have disappeared, after which half an hour's soaking in cool water or five minutes in tepid water will be sufficient for the unexposed parts of the gelatine to absorb the necessary quantity of water. The print may be

pigmented immediately, or hung up to dry, and inked at some later period. In this case it will require, of course, a preliminary soaking, rather more prolonged than the first one, for gelatine that has dried once will be tougher than usual.

Alcohol and ammonium bichromate sensitised papers print very quickly. A transparent negative of the kind that bromide workers would call thin, will not require more than two and a half minutes' exposure in diffused light on a bright summer's day—five or six minutes in winter. This for No. 100 double transfer Horseshoe paper, the coating of which is thin. No. 125 will require, for an opposite reason, double the exposure. But on no account must the opacities of the negative be printed through; in all cases no details, or only faint details, should appear in the high lights.

The gelatine surface of our print must be damp, and must be kept so during the whole period of pigmenting, or it will take the ink on its whole surface; also that it must not be actually wet, because of the presence of even a very thin layer of water over the insoluble parts would destroy the difference of texture between them and the swollen portions of the film. These two important conditions may be fulfilled by gently pressing a sheet of fluffless blotting-paper over the gelatine side of print, until every apparent drop of water has been sucked up, and by using as a desk on which the print will be placed during development, a thick pad of soaking wet blotting-paper supported by a sheet of strong glass. The operator will now choose his inks, according to the degree of exposure he has given, and to the effect he is striving after; bearing in mind that tacky ink will produce grain and contrast, fluid ink smoothness and flatness.

M. Demachy proceeds to explain his methods of applying the pigments in building up the picture. "B.J." (from "Camera Work"), October 19, 1906, p. 825.

Photographic Enamels.

Ceramics.—H. C. Ter Meer gives directions for the iron dusting-on process of making ceramics, working from a negative instead of a positive. He uses the formulæ for Poitevin or Obernetter.—"Photo. Era," March, 1906, p. 148; "B.J.," April 6, 1906, p. 269.

Platinum Printing.

Iron in Platinum Prints.—J. H. Baldock, on the results of chemical tests, concludes that, working under commercial conditions, where several prints have to be in the baths at one time, and no very great length of time allowed, it is practically impossible that all the iron can be removed. The prints, nevertheless, show perfectly pure whites, and, under ordinary conditions, do not seem to be any the worse; yet, under certain circumstances, the presence of the iron may make itself uncomfortably felt.

That all the iron can be removed is proved by an experiment in which a half-plate piece of the paper was kept for forty-eight hours in the bath of perfectly pure hydrochloric acid ½oz. to the pint of pure distilled water, changing the bath at frequent intervals, washing, drying, calcining, etc., as before, with the result that

practically the whole of the iron was removed and proved unweighable, an almost invisible quantity remaining at the end of the operations.—"B.J.," Dec. 1, 1905, p. 948.

Blue Platinum Prints.—A. J. Jarman gives directions for producing platinum prints of Prussian blue colour by addition of ferricyanide to a developer of: Potass oxalate, 4oz.; soda phosphate, 1oz.; oxalic acid, 2 drachms; boiling water, 14oz. About ½oz. (fluid) of saturated solution of ferricyanide is added to the above quantity. The prints are developed and fixed in acid in the usual way.—"Photo-Beacon," March, 1906, p. 92. (Why not make the prints on ferro-prussiate paper in the first instance at about one-tenth of the cost.—Ed. "B.J.A."]

Green Tones.—T. A. Aldridge advises the following for the Ilford "Platona" paper: A very good and bright green colour can be obtained by toning a medium print, developed with the Ilford formula, to a warm brown in the uranium bath containing a very little sodium sulphite, about the size of a pea, and then placing (without washing) in a bath of:

Ferric chloride, 8 grains.
Vanadium chloride, 10 grains.
Distilled water to 2oz.

Toning will probably take from three to five minutes.

Another shade of green, dark olive, was obtained with a mercury-toned print toned to dark brown in 2oz. of uranium toning bath, to which three grains of sulphocyanide of ammonium were added. The print was then placed in the above bath, which had been used once for the bright green toning.

A good shade of dark green was obtained with a mercury-developed print toned in the uranium bath (3oz.) with ten grains of sulphocyanide of ammonium added, and then placed in a bath of ten grains of ferric chloride and four grains of vanadium chloride.

The green toning seems to be as permanent as the brown and blue, and there is no reason why, if treated in the same way with the acetic acid bath before mounting, the prints should not keep their colour for years.

In using vanadium chloride, it is well to dissolve 32 to 35 grains in one drachm of pure hydrochloric acid with distilled water to 2oz. This will give approximately two grains to the drachm. The vanadium chloride will take some time to dissolve—quite forty-eight hours or more—and it should be shaken several times.—"Phot. Scraps," Feb., 1906, p. 10.

Varnishing Platinotypes.—E. Valenta recommends the following varnish for brightening up sunken-in platinotypes:

Sandarac	2 ozs.	100 gms.
Benzole	8 ozs.	400 ccs.
Acetone	8 ozs.	400 ccs.
Absolute alcohol	4 ozs.	200 ccs.

The print should be well brushed over with the above, and then excess of varnish blotted off with clean white blotting-paper.—"Phot. Korr.," Feb., 1906, p. 69.

Developing Platinotypes.—Dr. Jacoby states that the following developer will give warm blacks with absolutely pure whites on ordinary black tone platinotype paper:—

Potassium oxalate	250 parts.
Zinc oxalate	100 parts.
Water	1,000 parts.

Heat to 77 deg. Fahr. If the colour obtained is too warm, less zinc oxalate should be used. To obtain sepia tones, he recommends the use of ammonium monophosphate, NH_4, H_2, PO_4, with a little cupric sulphate.

Potassium oxalate	200 parts.
Ammonium monophosphate	50 parts.
Cupric sulphate	2 parts.
Water	1,000 parts.

The prints should remain in this developer at least five minutes.—"Eder's Jahrbuch," 1906, p. 140.

On the use of Japine platinotype papers.—"B.J.," Oct. 12, 1906, p 807.

Iron Printing Process

(other than Platinum).

Water-Developing Kallitype.—Jas. Thompson gives the formulæ for obtaining brown tones by simple water development as follows: The paper is first salted with—

Distilled water	1¼ ozs.
Nitrate of iron	50 grs.
Oxalate of potass	40 grs.
Oxalic acid	6 grs.
Bichromate of potass., 5 per cent. solution	10 drops
Stronger ammonia	10 drops
Gum arabic	10 grs.

When bone dry sensitise with the following:

Distilled water	1 oz.
Silver nitrate	50 grs.
Citric acid	30 grs.
Tartaric acid	10 grs.
Gum arabic	5 grs.

After coating let the paper become surface-dry; then hasten by artificial heat of low temperature. Heavy rough papers, however, such as the Whatman water-colour, should be dried as quickly as possible, so as to insure a vigorous image.

Printing should be stopped before half-tones are visible. Wash away the unaffected salts, as is the procedure with blue prints, this at the same time developing the image to full vigour. Fix for from three to five minutes in a solution consisting of a grain and a half each of hypo and common salt to the ounce of tap water. Exact quantities here not essential, providing the print is not bleached. When fixation is complete, wash in running water

for half an hour, drying between blotters or on clean papers.—"Cam. and Dk. Rm.," July, 1906, p. 223.

Iron Citrates.—Dr. G. Siboni has prepared a considerable number of the iron citrates by acting on citric acid, iron, caustic soda, and ammonia:—In the formulæ here given H_3Ci stands for citric acid, $CH_2^1COOH.C.—OH.COOH.CH_2^1COOH$, H_3^1 being the three hydrogen atoms of the carboxyl groups. 1. Ferrous citrate: $H.Ci.Fe'' + \frac{1}{2}O$, by direct action of Fe upon H_3Ci; a pale green crystalline salt not readily soluble in water; forms supersaturated solutions. 2. Ferrous ammonium citrate: $CiFe''NH_4$ by solution of No. 1 above in ammonium hydrate; unstable, loses NH_3 at 120° C., readily oxidises to ferric salt. 3. Ferrous sodium citrate: $CiFe''Na$, by addition of NaHO, or Na_2CO_3 to No. 1 until neutral. 4. Ferric citrate: $CiFe''' + 3H_2O$, by solution of freshly precipitated ferric hydrate in the acid; though nominally a neutral salt, has an acid reaction, and takes up NH_3 with evolution of heat, resulting compounds being named by the author "ammines." 5. Ferric mono-ammine citrate $Ci_2Fe_2NH_3$. One kilo. of citric acid is digested with the ferric hydrate obtained from 3 kilos of ferric chloride solution; after filtration, 207 grams ammonia solution, specific gravity 0.925, are added, the mixture being concentrated and dried on glass plates, forms bright red flakes with acid reaction. 6. Ferric diammine citrate $Ci_2Fe_2(NH_3)_2$, prepared as above but with double the amount of ammonia; also formed by oxidation of No. 2 salt. Dark brown, acid, deliquescent. 7. Ferric triammine citrate $Ci_2Fe_2(NH_3)_3$ by complete neutralisation of No. 4 with ammonia. The official iron and ammonium citrate of the British, Dutch, Italian, Swiss, and U.S. pharmacopœias. The German, Russian, Norwegian, Roumanian, and Greek pharmacopœias prescribe an addition of citric acid to the ferric citrate before neutralising with ammonia. In this way combinations may result of the following constitution:—8. Mono-ammonium ferric citrate, $H_2Ci_3Fe_2(NH_4)$, from 598 grams ferric citrate, and 210 citric acid dissolved in a sufficiency of water, and treated with 85 grams 20 per cent. ammonium hydrate. Yellowish-brown flakes deliquescent strongly acid. A. Biammonium ferric citrate, $HCi_3Fe_2(NH_4)_2$ as above, but twice the amount of ammonia. Greenish-yellow flakes, very deliquescent. 10. Triammonium ferric citrate, $Ci_2Fe(NH_4)_3$ as No. 8, but three times the amount of ammonia. Similar in properties to No. 9. 11. Tetra-ammonium ferric citrate, $Ci_3Fe_2(NH_4)_3(NH_3)$ as No. 8, but with fourfold the quantity of ammonia. Must be evaporated at low temperature, otherwise NH_3 is evolved. Corresponds with the German official compound.—"Apothetische Zeitung," 1905, p. 1,018. "B.J.," Mar. 16, 1906, p. 208.

COPYING TRACINGS.

The Rondinella Machine, for continuous copying of long tracings on ferro-prussiate and ferro-gallic papers, is described, with drawings, in "B.J.," Feb. 9, 1906, p. 108.

Catatype Printing Processes.

(Chemical Printing Without Light).

The case is recorded of a platinotype print having transferred its image to the back of an unfixed silver print with which it lay six months in contact. The transfer is evidently due to the catalytic action of the platinum image.—"A.P.," Oct. 31, 1905, p. 342.

Dr. Gros, who, in conjunction with Dr. Ostwald, patented the catatype process, explains that catalysis is the change in the rapidity of a chemical reaction produced by a substance which does not itself take part in the reaction though it may be affected by a secondary action. A well-known example of this is, of course, hydrogen peroxide solution and platinum, for the addition of the latter at once causes a copious evolution of oxygen. The quantity of platinum required to produce this action is extremely small, for if to 1 c.c. of a 1:50 normal solution of peroxide 0.000,003 gm. of colloidal platinum be added the whole of the oxygen is given off in three hours. An analogous case occurs with a mixture of chlorine and hydrogen, the addition of 0.1 milligrammes of colloidal platinum to 50,000 times the quantity of H + Cl produces chemical combination. If this fact be true of catalytic agents, then it should also apply to anticatalytic agents, and Gros finds that minute additions of iodine, mercuric chloride, sulphuretted hydrogen, hypo, or hydrocyanic acid will act as anticatalytical agents, and that the addition of 0.000,000,001 gramme of hydrocyanic acid per c.c. will reduce the catalytic action of 0.000,006 of colloidal platinum to one-half. Dr. Gros suggests that we have in these "anticatalytic" salts powerful agents which will make the process of more practical value.—"Bild," Jan., 1906, p. 319.

Copying Prints with Hydrogen Peroxide.—M. Du Bois, on behalf of the Technical Committee of the Photographic Society of Philadelphia, stated that hydrogen peroxide was active in a very weak solution, even a 2 per cent. solution diluted in the proportion of 1 to 500,000. Blotting-paper immersed in this solution and allowed to dry four or five hours was then placed in contact with the object to be reproduced, next to a photographic plate. At a temperature of 50 degrees C., the action was complete in twenty seconds. At the ordinary temperature, it required ten to twenty minutes. The action was purely chemical. The influence was shown through celluloid, 20-1000 of an inch in thickness. It was possible to show the texture of paper, and detect erasures, and letters which had become illegible through the fading of the ink were reproduced perfectly. Strips of red celluloid cut off the action of the chemical, but green or blue celluloid strips permitted it.—"Phot.," Feb. 14, 1906, p. 209.

Catatype Patents.

Dr. O. Gros patents the conversion of the silver image of a negative on glass or paper into one of the higher oxides of manganese. His object appears to be the production of an image

which retains its chemical activity towards hydrogen peroxide for a greater time. The treatment recommended consists in the employment of a solution of manganese peroxide in excess of tartaric acid with the subsequent addition of sufficient caustic soda to render the liquid alkaline. Or a solution of potassium permanganate may be mixed with sodium tartrate solution so as to leave an excess of the latter. Whichever mixture is employed, the print is afterwards washed for a short time and transferred to an alkaline solution of potassium ferricyanide. —Ger. Pat., No. 157,411, Aug. 23, 1903; "B.J.," Dec. 30, 1904, p. 1101.

Developing Hydrogen Peroxide Images with Ammoniacal Manganese Solutions.—The Neue Photographische Gesellschaft have supplemented a previous patent (Ger. Pat., No. 147,131) in which the formation of an invisible image is obtained by catalysis from an original photographic image by soaking in hydrogen peroxide, pressing against a paper and then developing with a solution of a salt of manganese and ammonia; the improvement consists in obviating a deposit of manganese hydrate in the developing solution which rendered the whites dirty, by using ammonium chloride: a suitable solution being 1 part of 25 per cent. of manganese sulphate solution, 3 parts saturated solution of ammonium chloride, and 1 part of saturated aqueous solution of ammonia.—Ger. Pat., No. 158,368, Jan. 11, 1903.

The Neue Photographische Gesellschaft patents a series of processes to modify the action of the negative or positive on the catalytic agent. Defects in catatype printing are overcome by treating the catalysing original with substances which diminish its effect on the substance which is to be modified by catalysis. As particularly useful, the following materials and method of applying them may be cited: 1. A platinum negative is bathed with a solution of 0.1 gram of thio-urea or of 0.2 gram of thio-sinamine or of 20 drops of a saturated aqueous solution of sulphurous acid, in 100 grams. of a mixture of 4 parts of alcohol and 1 part of water. The catalysing effect of the negative is thus so strongly reduced that a soft positive may be obtained therewith. 2. A manganese negative is similarly treated with a mixture of 4 parts of alcohol and 1 part of water, containing 0.1 per cent. of thio-urea. The action is the same.—Eng. Pat., No. 20,372, 1905; "B.J.," Jan. 5, 1906, p. 16.

A patent (No. 10,078, 1906) of the Neue Photographische Gesellschaft claims methods of protecting surfaces from hydrogen peroxide vapour as an addition to processes of catatype printing.—"B.J.," Aug. 24, 1906, p. 673.

Indirect Catatype Pigment Prints.—A German patent has been granted for the following process: a negative is made from a transparency on carbon tissue, supported on celluloid, and developed, and allowed to remain on its support. This image is then converted into a catatypic image—either by immersion in silver nitrate solution or by painting with the latter—and the silver is reduced by a developer; or the negative is soaked in solution of chloride of gold or platinum, and then treated with a suitable developer. For

instance, the above pigment negative may be bathed with permanganate of potash solution, and it will then be actively catatypic as peroxide of manganese is formed in the film.—Ger. Pat. No. 171,135, 1903; "Phot Ind.," June 6, 1906, p. 559.

The Neue Photographische Gesellschaft, of Berlin, have added to their previous inventions in catatype printing the following process, by which the image is obtained directly from the hydrogen peroxide. A surface impregnated with cobaltous salt is pressed against the print treated with hydrogen peroxide, and a visible image produced at once. The addition of an alkaline salt of a feeble acid is advisable. Thus:—

A solution of 8 grams of cobaltous acetate in 50 c.c. of a solution of gelatine of 10 per cent. strength is mixed with a solution of 7 grams of borax in 100 c.c. of gelatine of 10 per cent. strength, and paper or glass coated with the mixture applied to a print treated with peroxide.

Gum-printing paper and pigment paper may also be prepared by this process by adding to the mixture of gum or gelatine and colouring matter the selected salt, such as cobaltous acetate or another cobaltous salt, or a mixture of a cobaltous salt with an alkali salt of a feeble acid. By the action of the hydrogen peroxide the gum or the gelatine is made insoluble in warm water.—Eng. Pat. No. 7,933, 1906; "B.J.," Oct 19, 1906, p. 833.

Miscellaneous Processes and Prints on Various Supports.

Silver Chromate Prints.—A. J. Jarman prints on collodio-chloride paper until image is lost in over-printing, and prepares stock solutions as follows:—

No. 1.—Saturated solution of bichromate of potash.
No. 2.—Citric acid, ½oz. in 5oz. of water.
No. 3.—Hyposulphite of soda, 4oz.
Dissolved in water, 25oz.

He washes prints well, and immerses them in—

Hypo solution	10 grs.
Water	10 ozs.
Bichromate solution	1 oz.
Citric acid solution	3 drachms

until depth is about right, and washes in clean water. The process gives a warm sepia colour.—"Phot. Beacon," March, 1906, p. 89.

[It is difficult to imagine how permanency can be assured by such a process, or how results of uniform quality can be turned out.—Ed. "B.J.A."]

Solar Prints.—Hildebrand suggests the following method of making solar enlargements:

Milk	20 ozs.
Glacial acetic acid	¾ oz.

Mix, stir well, and filter, and then add to the filtrate:

Potassium iodide	140 grains.
Potassium bromide	34 grains.

Paint the solution over the paper and dry as quickly as possible. The prepared paper can be either floated on the following bath, or it may be painted on:

Silver nitrate	42 grs.
Distilled water	1 oz.
Glacial acetic acid	63 minims.

The paper must be exposed wet, and it is from three to four times slower than slow bromide paper. The developer is:

Pyro	3 grs.
Water	1 oz.
Glacial acetic acid	40 minims.
Citric acid, 10 per cent. solution	4 drops.

—"Der Phot.," "B.J.," Mar. 30, 1906, p. 246.

Double-Effect Prints.—A patent of H. C. Decks describes the method of making corrugated prints, which show one of two pictures, according to the direction in which they are viewed.—Eng. Pat., No. 91, 1906; "B.J.," Aug. 3, 1906, p. 613.

Phosphorescent Printing Paper.—R. Bau prepares a sensitive printing paper in which images in phosphorescent sulphides are obtained. One cubic decimetre of the paper pulp is mixed with 150gms. of calcium sulphide, 30gms. of zinc sulphide, and 20gms. of strontium sulphide. The paste is made into paper in the usual manner, and this, when dry, is rendered impervious with a lac varnish. The paper is then coated with a sensitive silver emulsion. It gives phosphorescent prints when exposed beneath a negative and finished as usual, but it can hardly be supposed that a film of lac can preserve a sensitive silver emulsion very long from the effects of a substratum of sulphides lying immediately below it.—Fr. Pat., No. 350,289; "B.J.," March 23, 1906, p. 208.

PRINTS ON FABRIC, ETC.

Photographs on Silk.—Details of a diazo process of printing in various colours from a positive transparency are given by F. J. Farrell in a paper before the "Society of Dyers and Colourists," reprinted in "B.J.," March 2, 1906, p. 168.

Prints on Metal.—E. Jabulowsky and A. Bourguin employ the powder process for pictures on a metal support. The powdering of the picture is effected with pure white silver in a pulverised state by means of a brush, after which the glass plate on the side carrying the sensitised layer is covered with collodion of 2 per cent. When the collodion layer has dried, the picture-film with the collodion layer is cut to the desired size. The removal of the film from the glass plate is effected in a bath of 300 gms. distilled water with 10 gms. ammonia. The loosened film is then placed in a bath of distilled water and carefully spread by means of a brush over the metal plate or article to be ornamented. After drying, the plate is heated over a gas flame or in a furnace until the collodion layer is removed and the photographic picture is completely united with the metal article.—Eng. Pat., 14,410, 1905.

PRINTS IN RELIEF.

Prints in Relief.—Mrs. W. B. Bryant prepares relief photographs as follows:—Selecting a rich, vigorous negative, a print is made on a bichromated gelatine film containing sugar, etc. To make the sensitive film, 300 grs. Nelson's opaque X. opaque gelatine are soaked in 2 ozs. of water, and 150 grs. of loaf sugar dissolved in 1 oz. of water added. The solutions are mixed and 10 grs. of potass bichromate dissolved in ½ oz. of water, added. The mixture is filtered through cambric on to a levelled glass plate, which has been previously waxed as for double transfer carbon. Four strips of wood are laid round the edges of the glass to permit of a coating at least ⅛in. in depth. After drying the film—the process must be done in a drying box, with calcium chloride, and may occupy a week—the film is stripped off the glass and exposed under the negative. It is then put to swell in water—best in the dark—for from ten to eighteen hours, which is sufficient to give a strong relief by the swelling of the less exposed parts. From this relief, while wet, a cast is made in plaster of Paris.—"Phot.," July 10, 1906, p. 33.

Photographs with Appearance of Relief.—P. Baruffi patents the taking of a positive from the negative of the subject, the positive and negative being then superposed and a third photograph being taken of the pair thus superposed whilst their picture surfaces are displaced. The third print is then transferred to stone or plate for printing in apparent relief. In the production of the third plate from the superposed negative and positive, the shifting of the negative and positive takes place, during exposure, by any micrometer screw arrangement. The picture printed on the third plate is not, however, employed as in the known processes for producing independent relief pictures with raised or sunken outline, but is used for the production of a printing block. This block is used for printing, and a picture is obtained therefrom which gives an appearance of light and shade effects as if in actual relief. To obtain delicate blended effects of light and shade upon the third plate, the first and second plates are laid one upon the other, so that the picture outlines are first coincidental, and the displacing of the one plate against the other is only effected during the exposure. The high appearance of the reliefs and the breadth of the shades also depends upon the degree of displacement of one plate with relation to the other. In similar manner, quite different reliefs can be produced having very fine light shades, or strong coarse shades, for instance, according as during the exposure the plates are shifted little or much. The most diverse appearances of relief or intaglio for prints can be obtained, according as the plates are brought with the film or plain glass surfaces together. As the time of exposure is, as a rule, fixed, so would the degree of displacement, and naturally also the quickness of displacement be influenced.—Eng. Pat., No. 5,559, 1905.

Mounting and Mountants.

Self-Mounting Paper.—Warwick Brooks proposes to coat paper (before sensitising) with shellac or other waterproof substance which is softened by heat. The finished prints are then mounted by

passing a hot iron over prints, card, or mount, or by otherwise subjecting them to heat. Reference is made by the Comptroller to the specification of Derepas Frères, No. 17,471, 1901.—Eng. Pat., 25,022, 1905; "B.J.," Aug. 17, 1906, p. 654.

For borax as an advisable addition to the mountant for P.O.P. prints, see under "P.O.P."

Multiple Mounting. — E. T. Holding illustrates many detailed directions for mounting prints on a number of papers.—"P.N.," Sept. 14, 1906, p. 730.

FRAMING.

Airtight Framing.—To secure enlargements, etc., as much as possible from injurious fumes (burnt gas, etc.), the glass of the frame is first secured in the rabbet with strips of good quality paper stuck on with paste. Then the print is placed in, and on that a closely-fitting backboard is secured with brads. A piece of stout brown paper is then damped, allowed to expand, and then fastened with glue to the back of the frame only—not to the backboard. When dry, the paper will be as "tight as a drum," and should at any time the backboard shrink no fumes would get in.—"B.J.," Aug. 24, 1906, p. 663.

Enlarging.

Exposure in Enlarging.—Edward S. King advises, as a simple test of the light in enlarging, to interpose a lighted candle in the beam of light from the lens and note the shadow of the candle itself as cast on the dummy. This effect is shown in the figure. By moving the candle toward the dummy, a position is found where the light from the candle just obliterates the shadow cast by the



light from the lens. The distance of the candle from the dummy is a measure of the light, and the exposure is proportional to its square. For example, it was found for a certain class of work with Seed process plates that squaring the distance expressed in inches, and dividing by 4, gave the exposure in seconds. The rela-

tion of the exposure in seconds to the square of the distance in inches is easily found by trial, for we can use the candle test with exposures obtained by any method, and determine the ratio from the best results. The kind of candle is not material so long as we use the same for all our experiments. There is some difficulty in noting just where the shadow disappears, and different eyes may vary in fixing the exact point. In general, a gentle lateral movement of the candle will enable one to see the shadow better, and make the observation of the disappearance more accurate. If the light from the lens is too faint to cast a shadow of the candle at a reasonable distance from the dummy when the aperture to be used for the enlargement is in place, we may increase the aperture for the test and allow for the change in the computation. This method of finding the exposure, if not exact, nevertheless affords a better approximation than given by the unaided judgment.—"Photo. Era," Feb., 1906, p. 94; "B.J.," March 9, 1906, p. 188.

Exposure in Daylight Enlarging.—A. Lockett advises the use of an actinometer as follows: The watch form, with a couple of small standard tints placed against an opening in the dial, under which fresh paper can be drawn as desired, is the most suitable. The best method of using is to have an extra aperture in the shutter, provided with a hinged lid or sliding door. Over this is fixed a projecting bracket about a foot long with a hook or wire arranged so that the actinometer may hang level with the aperture. The latter must be screened or curtained to prevent any light reaching the enlarging bench or easel, but in such a manner that the actinometer can be readily watched by the worker from within the room. To use this arrangement, a fresh piece of paper is brought under the opening of the actinometer, and, the sliding door of the small aperture being drawn up, the time taken by the paper to match the full tint is carefully noted. We will suppose this to be 20 sec. At or about the same time a test strip of bromide paper is being exposed for the enlargement, and the section which gives the best result on development is, let us say, that which has received an exposure of 30 sec. When we come to exposing the actual enlargement, the light has perhaps changed, but by making a fresh actinometer test, simultaneously with starting the exposure for the enlargement, no difficulty will be found in allowing for this. The actinometer this time, for instance, takes 40 sec. to reach the full tint. A simple proportion sum, therefore, gives us

$$20 : 40 : : 30 : 60 = 1 \text{ min.}$$

as the correct exposure now necessary. It is much more convenient if the enlarging objective is fitted with a pneumatic shutter and bulb, since the bulb can then be held in the hand while watching the actinometer, and the exposure given simultaneously or instantly after. When the light is dull, the quarter-tint may be used instead of the full tint, making the necessary allowance in calculating.—"B.J.," Oct. 27, 1905, p. 845.

Local Development.—C. Welborne Piper recommends the following method as permitting defects caused by the negative to be remedied during development: After exposure, soak the print very

thoroughly in clean water, and apply the developer for three or four seconds only, replacing it at once with clean water. The developer must be poured off before the image has begun to appear. The image will soon appear in the more fully exposed parts. The less exposed portions will not be fully apparent, and may even be represented by blank paper, and the next proceeding is to develop up all such parts with a soft camel-hair brush charged with the developer and applied to the print through the water. The presence of the water will not prevent the action of the developer, but it will absolutely prevent the appearance of stain or of hard outlines, hence this brush treatment may be continued as long as is necessary with perfect safety.

When the less-exposed parts are sufficiently developed, the water is poured off the plate and replaced by the developer, and the print is finished off in the usual way. There is, however, an important point to notice. If the less-exposed parts are only brought out by the brush to the same stage as the more fully-exposed parts, they will again lag behind when the developer is re-applied, therefore they should be developed up with the brush until they appear to be far more completely developed than the rest. The final development will then bring all parts of the image up to the same finished density in the same time.—"Focus," April 4, 1906, p. 319.

Solar Enlargements.—The following method for making these is given:—Dissolve as much fresh caseine as possible in 100 gms. liq. ammonia, sp. gr. .650, press the mass through linen and allow to dry. Of this take 30-40 gms., powder it, and rub up with a little water in a mortar, and then add 100 ccs. of water, and boil till it forms a jelly, and then add 3 gms. boracites citratus, dissolved in 80 ccs. of water. This boric acid preparation is made by rubbing up together 100 gms. chemically pure hydrochloric acid with 100 gms. of boric acid, and adding 60 gms. citric acid rubbed up with as little alcohol as possible. The caseine-boric mixture should be allowed to cool, the scum removed, the mass pressed through a fine cloth, and spread with a soft pad on the paper. The paper will keep any length of time, and is salted by floating for two to three minutes on

Ammonium bromide	20 gms.
Magnesium iodide	48 gms.
Magnesium chloride	8 gms.
Water	1,000 ccs.

It should be sensitised on

Silver nitrate	100 gms.
Distilled water	1,000 ccs.
Glacial acetic acid	40 ccs.

Small sheets should be floated, and for larger sheets the solution should be applied with a pad. The paper should be exposed whilst still damp till the details are visible, and then developed with

Gallic acid	20 gms.
Lead acetate	10 gms.
Glacial acetate acid	75 ccs.
Water to	1,000 ccs.

After development the prints should be immersed in weak soda solution, fixed, and washed, and if a purple tone is required, should be toned in an acid toning bath.—"Der Phot.," 1906, p. 118.

Enlargements direct on gum-bichromate paper (see under "Gum-bichromate").

Enlarging Films by Expansion.—Will Cadby causes Cristoid films to stretch as follows:—A sulphuric acid bath of from 1 to 2 per cent. is made up, and kept at a temperature of 70 degs. F. in a porcelain dish over a paraffin stove. It is not advisable to let the bath get any hotter than this, although, if the film under treatment happens to be composed of fairly tough gelatine, it would stand several degrees more heat. A piece of glass, large enough to take the negative when expanded, is carefully cleaned and laid in the dish containing the acid solution, and the film is then immersed with the glass under it. This glass in the dish is a great help, as the film may get tender after it has been in the acid some time, and in this state it is better not to lift it by the corners, not only because this is inclined to stretch it out of shape, but also for the reason that the corners may come off in one's fingers. But with a piece of glass under it the film can without risk be shifted from one dish to another.

Soon after coming in contact with the acid the film first contracts and gets considerably smaller, but it quickly relaxes and returns to about the size, or a little larger, at which it started the operation. The next noticeable alteration will be a general flaccidness and limpness, and the edges will be wavy. This happens in about twenty minutes after immersion in the acid bath. When this is observed, it is time to carefully remove the glass with the film lying on it to a bath of not quite cold water, and occasionally give it a gentle rocking. The water bath is meanwhile allowed to get cold.

The negative will go on growing in size for half an hour or so in the cold water, but it must be rocked fairly often, or it may not expand evenly, and air bubbles must not be allowed to settle in places under the film. The changes of water should also be fairly frequent, as it is necessary to wash the acid out of the film.

When the film has finished stretching, if at all tender, it should be treated to the ordinary Cristoid hardening bath and given a few changes of water, and then it may be squeegeed on to the glass above which it has been reclining right through the operation, to dry.

The drying of these expanded films is rather a long business, taking in damp weather sometimes two, and even three, days.—"A.P.," May 8, 1906, p. 385.

W. Marshall uses a water bath for a more moderate but safer enlargement of Cristoids. By simple expansion in a water bath of 70 deg. for ten minutes—after fixing—and using no acid at all, enlargements as follows are obtained:—From quarter-plate glass negatives a positive copy on Cristoid films enlarged to 5½ by 4 ins., and a Cristoid negative off this positive enlarged to 7½ by 5½ ins. From half-plate glass negatives the positive copies on Cristoid enlarged to 8½ by 6½ ins., and Cristoid negatives taken off these again resulted in pictures of 9½ by 7½ ins. on an average, with no loss of detail that I can detect, but fully as good as the originals.—"A.P.," May 29, 1906, p. 448.

Working Up and Colouring Prints and Enlargements.

Crystoleum Colouring.—Mary S. Hampton uses a mounting solution of: Hard gelatine 20 grs., water 1 oz., to which about 5 drops of alcoholic salicyclic acid solution are added. The solution is used warm. Or, instead of this, a paste consisting of the above gelatine solution, mixed with an equal volume of starch paste. This is used cold.

Trim the print a little smaller than the size of the glass to be used; rub the albumen side gently with a piece of linen rag dipped in benzoline, plunge into warm water, and after two changes blot on a clean towel; place the albumen side upward on a hard, flat surface (a piece of clean plate), and apply the mounting solution, or paste, all over it.

To a previously clean convex glass apply some of the same mountant as used on the print all over the inside surface, then lower the print, albumenised side down, gradually on to the inside of the convex glass. It does not require any great amount of skill to do this without blisters or creases, but if such should occur, it may be easily withdrawn and mounted afresh. After squeegeeing with a squeegee (large pictures only), or with the finger, the photograph is left to dry and then rubbed down as thin as possible with sandpaper. It is then rendered transparent with:—

Canada balsam	5 ozs.
Solid paraffin	2 ozs.
White wax	2 ozs.

Melt at as low a temperature as possible, then place the picture therein, keeping the composition in a molten condition, either in a slow oven or on a water bath. If a high temperature be maintained the print will lose its whiteness, and when painted will appear somewhat bilious. At the end of an hour the picture should be examined, when, if it is quite transparent, it may be removed, and when cool enough the excess wiped off. If, on the contrary, opaque patches are still visible, it should be allowed to get cold, then rubbed down a little more with glass paper, and again put into the wax composition, allowing it to remain until the marks disappear. When cold rub off all excess and proceed with the painting. (The directions for this part of the process do not admit of useful abstraction.—Ed. "B.J.A.")—"Cam. and Dk. Room," Jan., 1906, p. 24.

Painting Enlargements.—Dunkman states that he has never obtained satisfactory results using water-colours or glazed colours for painting enlargements, as the photographic image always shows through and robs the colours of their brilliancy. Pastels are also unsatisfactory on the gelatine surface, and, whilst fairly broad masses can be put in, it is almost impossible to draw fine lines with them. The author strongly recommends the solid oil-colour pencils of Raffaeli, which can be sharpened to a fine point, so that the finest line can be drawn. They will take well on any surface, and in a few days will set as hard as ordinary oil colours. They have the brilliancy and luminosity of water-colours, without the troublesome glaze of oil-colours. The most delicate tints can be obtained by

mixing over white, or by using one colour over another, and if treated with a brush dipped in turps, soft, glossy mixtures are obtained. Mistakes can be erased with a knife, and lights can be put on by the same means, and they will be found to answer all the requirements of the painter.—"Phot. Chron.," March 7, 1906, p. 129.

Colouring Postcards.—A correspondent of the "Pharmaceutical Journal" vouches for the following being the method used in the commercial tinting of monochrome or mezzotint cards; these, of course, must not be confounded with those produced by the "oleo" process. In the first place, a camel-hair pencil is only used for spotting, practically all the colouring being done with an "air brush." The colours used by them are three in number, the simple primaries: "yellow," an aqueous solution of gamboge; "blue," an aqueous solution of indigo with oxalic or other acid; and "red," a solution of dragons' blood in methylated spirit—this is always used first. Aniline dyes are never employed, being too fugitive for exposure in a shop window.—"B.J.," Jan. 19, 1906, p. 55.

Coloured Miniatures, such as are cheaply sold for lockets, etc., are printed on P.O.P. The colouring is not a difficult matter. The colours needed are only three: red, yellow, and blue aniline dyes, but they must be colours that will mix. Red will usually combine with either of the others, but some samples of blue and yellow will not combine to form a green, but precipitate one another to a muddy mess at the bottom. Having procured these three colours, saturated solutions should be made. The print needs no preparation except wetting; the surface moisture is removed with a clean cloth, and the print is ready. A little of each of the three colours is poured out into separate saucers, and with a clean brush a little red is put into a clean saucer and considerably diluted, and a small proportion of yellow added, to form a flesh tint. It should be tried on a waste print. The brush is well filled with colour and mopped over the face, and almost at once the colour on the surface is wiped off with a piece of clean soft rag, rather moist, which is held in the left hand, ready to take up the surplus colour. The tint left on, or, rather in, the print will be perhaps too pale after only one application, and a second or third application of the brush may be necessary, always followed immediately by the clean rag. Any colour that is needed can be obtained by mixing the three colours in different proportions. For small parts, such as the lips and eyes, a fine sable should be used, and the colour should be less diluted. It is surprising what pretty effects can be secured by these simple means, depending on the taste and skill of the wielder of the brush. After the colouring of the print is finished it should be allowed to become "bone dry" before doing anything more with it. It will have an unfinished appearance, and needs to be glazed; this may be done in several ways, by cementing it upon a piece of celluloid, as recommended for "photo buttons," or it may be attached to the inner side of the glass of the locket it is intended to fill, with a little warm gelatine solution, or it can be enamelled by squeegeeing down upon a piece of clean French-chalked glass, or waxed ferrotype plate. If the print is thoroughly dry after colouring, it may be moistened for enamelling without fear of the colours running, but it must not be

left soaking too long or the colours will be washed out.—"B.J.," April 6, 1906, p. 262.

Fixative for Pastel Work.—Ostwald's caseine fixative, which is prepared as follows, is recommend for this purpose:—

White cheese	50 gms.
Liq. ammonia, to	150 ccs.

Rub the cheese in a mortar to a paste with a little of the ammonia, and then add the remainder, then add:—

Alcohol, 50 per cent,	200 ccs.

and place the bottle in a warm place till the sediment has subsided, then filter. Before use this should be diluted with weak alcohol and applied with a spray diffuser. If the enlargement is to be subsequently painted with water colours it should be sprayed over with a 2½ per cent. solution of dammar varnish in alcohol. — "Phot. Chron.," 1905, p. 654.

Lantern Slides.

Two-Colour Toning.—The slide is first under-developed and then intensified to the desired depth in mercury and ammonia. It is then well washed and placed for three minutes in a mixture of:—

No. 1.—Ammonium citrate of iron	16 grs.
Water	4 ozs.
No. 2.—Potassium ferricyanide	16 grs.
Water	4 ozs.

An equal quantity of each is mixed in a measure glass. To the mixture a few drops of a ten per cent. solution of nitric acid are added immediately before using.

It is then removed to the final washing, without any apparent change whatever having taken place. On drying, however, the sky will come out a delicate azure blue, the high lights will be very slightly tinged with blue, and the rest of the slide will present the warm brown tone which follows the intensification process. For certain subjects, notably those with clear skies and a foreground of water, these colours are most effective, the slight tinging of blue in the high lights of the water appearing only as the natural reflection of the bluer sky.—"A.P.," Oct. 31, 1905, p. 355.

Masking.—Rev. T. Perkins recommends the following methods:—Lay the transparency film downwards on a sheet of white paper, on top of this place the cover glass, having previously decided how much of the subject you wish to mask off, and stick bits of the binding strips to the top of the cover glass—it is easy to see where to place them, and also to get the corners true right angles, as all that is required is to fasten the strips with their sides parallel to the sides of the cover glass; if, then, after the cover glass has been warmed, it is laid down with the face to which the black strips are fastened upwards, and the lantern plate with the film downwards put upon it, the mask will cut out exactly what is required. If by any accident the strip has been incorrectly placed, it is easy to remove it from the cover glass, whereas, if it had been stuck to the film, it is not always

possible to remove it without injuring the film.—"P.N.," Nov. 17, 1905, p. 744.

Drying Slides.—T. Edwards uses a rack, in appearance very like a venetian blind, hanging against a wall, with the laths about five inches apart and turned horizontally. The wall is hung with blotting-paper, and strips of the same paper lie on each lath. The laths do not quite touch the wall, being held off by buttons at each end. When a rack of finished slides is lifted out of its last washing-water, each plate is stood on the lath, face to the wall and leaning against it at as blunt an angle as possible. The blotting-paper absorbs all drainage and a current of air continually passes between the slides and the wall. The rack is hung in a room free from draughts, and locked against accidental intrusion. In this way the air remains practically dustless, and the slides dry without extraneous blemish.—"Phot. Scraps," Jan., 1906, p. 5.

Varnishing Lantern Slides.—M. Remond suggests the use of celluloid varnish for protecting lantern slides from the effects of heat in the lantern, and states that when dry it is quite non-flammable. His formula is:—

Commercial celluloid varnish	4 parts.
Absolute alcohol	1 part.

Apply as with collodion; drain off the excess and wipe the lower edge, and corner with blotting paper. Allow to dry in a horizontal position, and then pass the slide, varnished side down, through the flame of a spirit lamp till all trace of moisture disappears. After this the slide can neither be damaged by the fingers nor will any heat in the lantern hurt it.—"Bull. Soc. Fr. Phot.," May 15, 1906. p. 240.

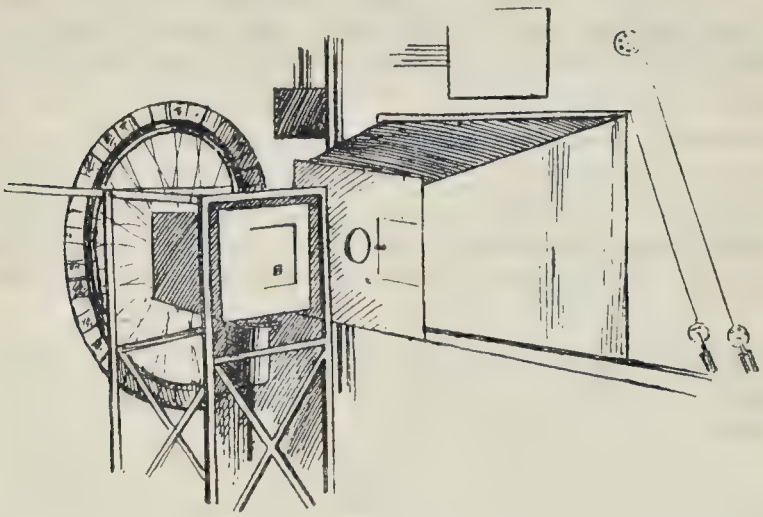
LANTERN PROJECTION.

According to the "Scientific American" the projection system of Prof. Eric Gérard, of Ghent, Belgium, permits the projection of lantern-slides in full light and without the aid of an assistant.

The projection screen is a sheet of plate glass, nearly 4ft. square, ground by means of a sandblast to provide a rougher surface than glass etched in the usual manner with acids. To avoid the necessity of darkening the room, a sheet-iron casing is provided which connects the screen with the projection lantern, thus inclosing the light beams and cutting off any side light. The projection lantern contains a continuous-current arc lamp with a regulator, adjusted for 15 ampères and located at a distance of about 7 feet from the screen. The beam of light obtained under these conditions is sufficiently strong to allow the projected image to be seen transparently through the ground glass throughout an auditorium containing 300 seats, while the room remains lighted up.

In order to dispense with the services of an assistant in bringing the slides successively before the lantern, all the slides to be used in a lecture are arranged beforehand at the periphery of a wheel resembling a bicycle wheel. By means of a special gearing the wheel is set rotating with a crank situated below the screen, so as to cause the slides successively to pass through the lantern. The wheel can

be turned backward and forward at will, so that any given picture can be reproduced over again. A switch placed beside the controlling



crank serves to light the projection lamp.—"B.J.," Jan. 12, 1906, p. 32.

CINEMATOGRAPH.

A. and L. Lumière have patented a system of cinematographic projection by means of two plane mirrors forming a right angle, the combination moving at its edge in a direction at an angle of 45 degs. with each face, and with a speed equal to half that of the film. The text and drawings of the specification (Eng. Pat., No. 7,482, 1905) are given in "B.J.," Dec. 8, 1905, p. 973.

Cinematography in Colours.—A patent supplementing that of Jumeaux and Davidson, No. 3,729, 1903, is taken out by W. Friese Greene.—Eng. Pat., No. 9,465, 1906; "B.J.," March 16, 1906, p. 213.

Stereo-Cinematography.—A method of stereoscopic cinematography is patented by H. H. Moon.—Eng. Pat., No. 4,423, 1905; "B.J.," Jan. 12, 1906, p. 33.

[*Space will not permit of reference to the numerous patents of cinematograph cameras and projectors. The specifications are published or abstracted in "The British Journal of Photography," and entered in the annual index of that publication under* (*1*) *Cinematographs, and* (*2*) *Name of Patentee.*]

VI.—COLOUR-PHOTOGRAPHY.

A review of current methods was read as a paper to the Photographic Convention by E. J. Wall, and appears in "B.J.," July 27, 1906, p. 588.

Direct Interference Processes (Lippman).

M. Lippmann, as the result of theoretical calculations, finds that the mirror in the interference process may be replaced by a Fresnel double prism, or a bi-prism, or any device for producing interference fringes. In practice, however, the two semi-transparent mirrors are found to be the only means.—"B.J.," Aug. 17, 1906, p. 614.

The Lippmann Process.—Dr. Lehmann states that all processes hitherto given for sensitising the emulsion for this process are based on an accurate proportion of the dyes, so that without a filter compound colours could be correctly rendered. Abandoning this method, the dyes are added in such quantities that each exerts its maximum action, and Dr. Lehmann uses a compensating filter, which enables all colours and even pure whites to be obtained. For the filter three stock solutions are required:—

1. Cyanine	0.4 gms.
Alcohol	200 ccs.
To be dissolved cold.	
2. Erythrosine	0.4 gms.
Alcohol	200 ccs.
To be dissolved cold.	
3. Aesculine	0.4 gms.
Hot distilled water	10 ccs.
When dissolved add:—	
Alcohol	190 ccs.
Ammonia, sp. gr. 0.91	3 drops.

To make the filter, stock solutions Nos. 1 and 2 must be diluted with 30 parts of water or alcohol. The actual filter which is used in 5 mm. width is:

No. 1 solution (1:30)	$2\frac{1}{2}$ parts.
No. 2 solution (1:30)	5 parts.
No. 3 solution undiluted	1 part.
Alcohol or water	$1\frac{1}{2}$ parts.

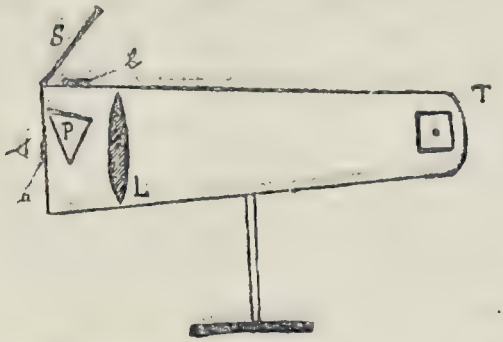
The solution must be kept in the dark, as the cyanine bleaches in sight. A useful substitute for the cyanine has not yet been found, though the following filter is the nearest:—

Methyl violet (1:15000)	0.6
Erythrosine (1:15000)	2.5
Aesculine (1:1500)	1.0
Alcohol	7.0

The above is a brief extract from a book, "Beiträge zur Theorie und Praxis der direkten Farben-Photographie Mittels Stehen der Wellen nach Lippmann's Verfahren," by Dr. Lehmann, which is shortly to be published.—"Eder's Jahrbuch," 1906, p. 49.

A New Stand for Lippmann Photographs.—Carl Zeiss has introduced a new apparatus for viewing Lippmann photographs; the construction of which is shown in the accompanying diagram.

It is a long box in the front of which are two holes *a* for the eyes. On the top is a mirror S, which reflects the light through two holes *b* on to the total reflecting prism P. The light is then transmitted by the convex lens L on to the disc T, which can be revolved, and carries four Lippmann photographs. The focus of the lens L is such that the light falls parallel on the photographs



and is thence reflected back to the eye. This is the most satisfactory arrangement, as the eye sees the pictures by means of rays which are perpendicular to the surface, and changes in the colour by alteration of the angle of the incident light, are excluded; and as all side light is excluded the brilliancy of the colours is not reduced.

[Lippmann's original viewing box was not fitted with the prism: the mirror on the top was adjustable at varying angles, and the viewing lens was placed in the eye holes.—Ed., "B.J.A."]

THE BLEACH-OUT PROCESS.

Dr. R. Neuhauss has investigated the effect of the physical character of the dye solutions on the rapidity of bleaching, using Siedentopf and Zsigmondy's ultra-microscopic method. He found that frequently one film of certain intensity was much less sensitive than two films superimposed, each of half the intensity. Many dyes show fine and coarse particles, and also a diffused colour, differing from the actual colour of the dye, and this increases with age and lowers the sensitiveness of the dye.

Chloral hydrate has been found to be the best sensitiser, and its action is increased by the addition of caustic soda, and 2 per cent. of chloral hydrate, with 10 drops of a 10 per cent. solution of caustic soda, should be be used. The exposure is reduced to one-fourth. Attempts to do away with gelatine as the vehicle, and the best results were obtained with a solution of celloidine in glacial acetate acid, with a few drops of turpentine as an accelerator; unfortunately erythrosine cannot be used with this, and no satisfactory red dye

was found. Neuhauss has found that the prints can be sometimes developed by repeatedly and momentarily dipping them into hot water, but this does not always succeed. The best results were obtained by treating them with 10 per cent. solution of potassium iodide, to which a few drops of chloride of gold solution was added; sometimes it was advantageous to subsequently treat the prints with hypo. The sensitiveness of prints thus treated was so lowered that they were practically fixed.—"Eder's Jahrbuch," 1906, p. 11.

Baron von Hübl, writing on Uto paper, made by Smith and Company, of Zurich, states that it has a gelatine film containing erythrosine and on the top a green collodion, formed by a mixture of blue and yellow dyes. The latter film contains anethol as a sensitiser, but the red film requires sensitising with hydrogen peroxide. A specially prepared paper is used into which the red dye does not diffuse. The unsensitised paper does not become white, even with very long exposure, but assumes a crimson red colour, for only the green film bleaches. After sensitising with the peroxide, the dyes bleach fairly evenly, and, under favourable conditions, prints, true to the original, with pure grey tones, can be obtained. The activity of the hydrogen peroxide soon decreases, and completely ceases when the paper becomes dry. The prints must thus be finished before the paper becomes dry, therefore one can only print in direct sunlight. In the shade only red prints are obtained, and also a piece of paper exposed by itself will not turn white, but remains red, as it dries before the complete bleaching of the erythrosine film. The paper only remains damp sufficiently long to completely bleach when in intimate contact with the original. If the paper, therefore, is not used soon after sensitising, or the light decreases during the exposure, reddish tints are produced. In such case supplementary sensitising may be resorted to. The printing frame should be opened and the back of the paper covered with a sheet of blotting-paper, soaked in hydrogen peroxide, and half dried. As the damp "Uto" paper adheres tolerably firmly to the original, one need not fear any movement. On the other hand, a freshly sensitised paper may give greenish tones in very strong light, for the red film bleaches too quickly. In this case it is advisable to cover the printing frame with a sheet of glass, coated with erythrosine collodion.

The necessary time of printing depends essentially on the intensity of the dye films. If these are thinly coated an exposure of from 20 to 30 minutes is enough in sunshine. In this case the paper shows only a dark grey colour, which, however, in the finished prints, is almost as good as black. If, on the other hand, the dyes are thickly coated, the paper appears, before exposure, black, and then an exposure of an hour or more is requisite. The fixation of the coloured prints presents no difficulties. The hydrogen peroxide is destroyed by complete drying of the picture, and in order to remove the anethol several hours' soaking in benzole is required.

The pictures obtained by means of the bleaching-out process actually deserve the designation of "colour photographs," for actual dyes give the colours, and these are directly produced by the action of light.—"Wien. Mitt.," September, p. 291. "B.J.," October 5, p. 778.

Dr. Smith states that the paper has been improved and that it is not now necessary to sensitise the paper at all, the necessary sensitisers being introduced in the film, and that the colours bleach out very rapidly and regularly, and the results are more correct. —"B.J.," October 12, p. 817.

Three-Colour Processes.

The Basis of Three-Colour Photography.—A. von Hübl, in a long and exhaustive paper, deals with the following points:—1. The difference between additive and subtractive colour mixtures. 2. The importance of the Young-Helmholtz theory in three-colour photography. 3. The difference between the additive and subtractive filters. 4. How should the filters be adjusted to a given make of plate? With regard to the first point, the author states that if two coloured lights are mixed there is always formed, together with the compound colour which lies midway between them, a certain amount of white; if one of the mixed lights alters, the mixture also alters; lights of similar appearance always give similar mixtures; the quantity of white which is formed in the mixture is greater, the greater the separation of the component colours; the brilliancy of the mixed colours is increased by the white, but the saturation is decreased.

In triple projection one of the lights is cut out by each positive, and therefore the latter appears on a white screen in the compound colour of the two other lights. If, for instance, a positive is placed in front of the red light, a blue-green positive image is formed on a white ground, and in the same way the blue and green projection images will give yellow and crimson images. The three constituent pictures thus show the same colours as those which are used in the so-called subtractive methods of three-colour photography, and their combination corresponds equally then to a subtractive method, for by their mixture there is formed not white but black.

By this statement a very clear connection between the two methods of three-colour photography is obtained; whilst, with the additive mixing of coloured lights, the spectrum composition plays almost no part, in the mixing of material colours, whether by the combination of powders or solutions or by the superposition of stained transparent films, the results depend essentially on the spectrum composition of the components. With regard to this the following rule may be laid down: If the absorption bands of the colours to be mixed overlap, the rules stated above for additive light mixture approximately applies to the subtractive colour mixtures, with this difference, that black, and not white, is formed with the compound colour. Suitably chosen colours thus behave exactly like spectrum lights if the tone of the compound colour only is considered.

As regards the Young-Helmholtz theory, it is pointed out, first, the disagreement between authorities as to the primary colours; and, secondly, that the chosen colours must actually be more saturated than the spectrum colours, which is an impossibility; whilst the primary colour theory may explain the physiological process of colour vision it is not applicable to three-colour photography, which reproduces all natural objects.

By means of diagrams the necessity of using red, yellow, and blue as the printing inks is proved, and the correct colour of these inks defined. Importance is laid upon the adjustment of the taking filters to the plates, and it is again proved that the Young-Helmholtz theory is inapplicable by the following reasoning:—It is frequently stated that as each of the three taking plates excites one group of nerve fibrils, the filters must therefore be so chosen that they transmit the rays of the spectrum in the intensity ratios of the primary sensation curves, which express the intensities in which the very saturated fundamental colours, red, green, and violet must be mixed so that the sensation of the spectrum colours must be produced. If the above views are followed it is determined that the ordinates corresponding to each spectrum colour are the measure of the transparency of the filter. If the transmitted spectrum rays are mixed, the colours obtained will be the colours of the filters. The red curve corresponds thus to a filter, which principally transmits yellow, orange, and yellowish-green light, less red and green, but some blue-violet. The colour of this filter will therefore be a brownish yellow, for pigments only appear pure yellow when they reflect or transmit the whole of the spectral green and red.

Such a filter may be easily obtained by mixing a solution of acridine yellow and naphthol green. It is obviously absurd to use this filter for trichromatic work, for even with a perfect panchromatic plate it would give perfectly useless results.

As regards the choice of the filter colours, von Hübl states that the simplest and safest method of determining and controlling the filters is by photographing pigmentary colours by the aid of a three-colour sensitometer or a colour chart. The colours for this chart should be vermilion red, ultramarine, and yellowish green, and they should be so chosen that when mixed by means of 120 deg. sectors on a colour top they should give a neutral grey, and should thus possess equal colouring powers. The yellow mixed with an equal quantity of ultramarine should give a neutral green. In the negative for the crimson constituent image, plate and filter must be so adjusted that crimson pigments are as inactive as black, those between blue-green and yellow be as active as white, and the vermilion lying midway between crimson and yellow and the ultramarine lying midway between crimson and blue-green must be half-tone in the negative. There can be no doubt that these mean colours, vermilion and ultramarine, can be formed by the combination of the constituent pictures, whether this is effected by additive or subtractive mixture, for they can only be formed by ½ crimson + ½ yellow or ½ crimson + ½ blue-green.—"Atelier," June, p. 63; July, p. 79; Aug., p. 97, 1906; "B.J.," June 22, p. 489; Aug. 10, p. 627; Aug. 31, p. 693, 1906.

APPARATUS FOR THREE-COLOUR PHOTOGRAPHY.

The Use of the Spectroscope.—Four articles by E. J. Wall treat of the different patterns of spectroscope and spectroscopic cameras and their use for measuring plates and light filters.—"B.J.," Apr. 20, p. 306; Apr. 27, p. 344; May 11, p. 364; and May 18, p. 385.

C. E. K. Mees describes a small concave-grating spectroscope.—"Phot. Journ.," Dec., 1905, p. 401.

T. Thorne-Baker, in a paper on "Spectro-Photography and Its Technical Applications," describes a modified form of spectrographic-camera, of resolving power, 2,000. He uses for his work a plate of speed, 200 H. and D., colour-sensitised with homocol and a black dye, and of grain less than .0025 of a mm.—"Phot. Journ.," April, 1906, p. 159.

Diffraction Grating Replicas.—R. J. Wallace, in a paper in the "Astro-Physical Journal," describes in detail his method of preparing replicas of diffraction gratings, using a solution of precipitated cotton in amyl acetate for taking the casts, which are afterwards mounted on gelatine-coated glass plates. The paper is printed in full in "B.J.," Nov. 24, 1905, p. 928.

Thomas Thorp, writing to "Nature," points out that the method of preparing replicas used by him is identical with that of Mr. Wallace, except that he finds mounting on a gelatine-coated glass unnecessary. —"B.J.," Dec. 1, 1905, p. 956; and "Phot. Journ.," Dec., 1905, p. 389. ("B.J.," Dec. 29, 1905, p. 1031).

R. J. Wallace publishes an improvement of the method of preparing replicas already worked out by him independently of T. Thorp. The original grating is flowed with the amyl acetate collodion and dried in the manner previously described; it is then placed in distilled water until loosened by contraction, and wiped dry. The stripping is performed as usual, and the edges of the cast are trimmed with sharp scissors close up to the ruled surface. This trimming should be done while the replica is held by the forceps, as it is strongly electrified by the stripping, so that minute particles of dust are attracted to the surface of the cast, and adhere thereto, being removable only with difficulty. A perfectly clean and polished glass plate is then flooded with filtered distilled water; and, while the plate still holds a little pool of liquid, the film is gently lowered into contact, carefully centred, and the plate is tilted up. A very gentle even pressure by the velvet rubber frees the cast from surplus water, and the edges are immediately cemented.

The mounting may be either face up or down, as may be desired.

After the edges have been cemented down, the mounted replica may be dried by heat, beginning gently and increasing gradually until a temperature of about 75 deg. C. is reached. In this way the film of water between the glass and the replica is driven off, the film being slightly porous.

If the replica has been mounted face down, it may readily be cemented under a covering glass, following the idea advanced by Ives.—"B.J.," June 8, 1906, p. 450.

THREE-COLOUR CAMERAS.

A three-colour camera, with automatic clock-work devices for changing the plate and the filter, has been patented by the Société du Photochrome, Paris.—Eng. Pat., No. 4,874, 1905; "B.J.," Mar. 2, 1906, p. 174.

Sir William Abney's design for a camera to make the three-colour records simultaneously is shown in Figs. 1 and 2. In the front of the camera are three small lenses; or three portions of one lens

may be used. The images from the two "side" lenses are deflected by mirrors or prisms so as to fall on the side portions of the camera. Meanwhile, the rays which traverse the central lens pass direct to the central section of the sensitive plate. In the path of the rays traversing the central lens, another lens preferably adjustable in the direction of its focal axis, is arranged; and between each outer section of the sensitive plate and the mirror pertaining thereto is also arranged a lens; these supplementary lenses enabling the focal length of the rays passing through each outer lens to be adjusted and made equal to that of the rays passing through the central lens, thereby ensuring the production upon the sensitive

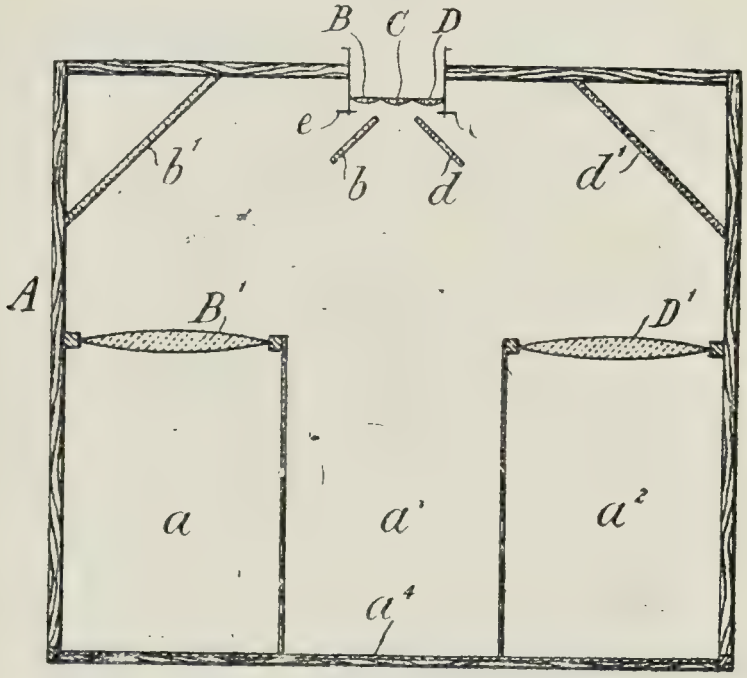


Fig 1.

plate of three pictures of exactly equal size. It can also be perceived that what may be described as the two "outside" cameras may be of fixed and equal focal length, whilst the central lens is of a different focal length, there being arranged within the central section of the tri-part camera an adjustable lens whereby the size of the image thrown upon the central section of the sensitive plate may be regulated to correspond with that of the images thrown upon the outer sections of the said plate. Or the focal length of the central camera may be treated as normal, and lenses employed in the two outside cameras for the purpose of adjusting the focal length pertaining thereto to that of the central camera. The apparatus may, therefore, be constructed with either one, two, or three pairs of lenses; but in all cases at least one pair is necessary in

order to equalise the focal lengths of the three members of the tri-part camera. When it is desired to use the apparatus in connection with colour screens, the lenses may be uncorrected for

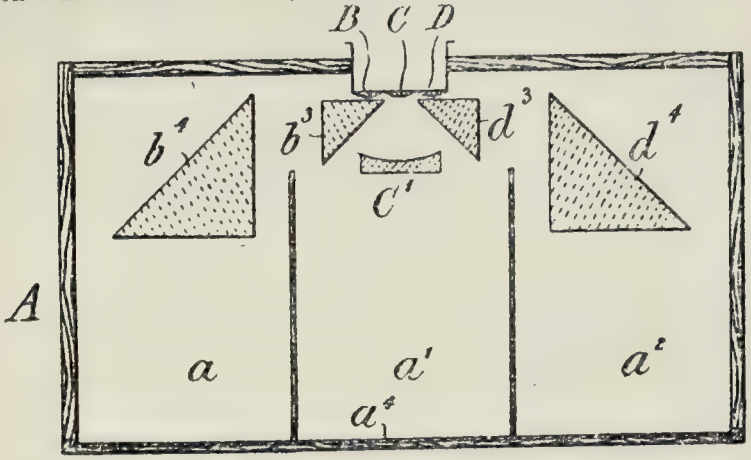


Fig. 2.

chromatic aberration; the distances apart of the compartments pertaining to the respective pairs of lenses being altered to suit the different focal distances yielded by the different colours. The brightness of the three images may be varied by varying the extent to which the three lenses are respectively screened. — Eng. Pat. No. 14,623, 1905; "B.J.," July 27, 1906, p. 593.

A. and L. Lumière have patented a one-lens, one-exposure, three-colour camera, the principal part of which is the divider (Fig. 1), formed of two sheets of glass, *d*, *b*, at right angles to one another and placed behind the lens, *o*, in the position shown in Fig. 2. The

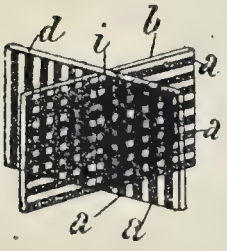


Fig. 1.

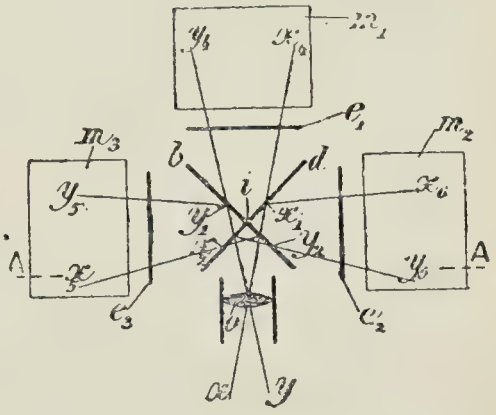


Fig. 2.

function of this divider is to direct the image formed by the lens into three directions so as to permit of the separation of rays by

filters suitably placed. The divider may be placed as shown in Fig. 1. The sheets of glass, *b*, *d*, are silvered on their surfaces next the lens in parallel bands, *a*, *a*, the width of these being equal to their distance apart, so that each sheet of glass is divided into alternate and equal transparent and reflecting surfaces. On one of these glasses, *b*, these bands are perpendicular to the intersection, *i*, of the glasses; on the other, *d*, they are parallel to the intersection. The divider thus formed is placed behind the lens, *o*, so that the axis of the lens is perpendicular to the intersection, *i*, of the two sheets of glass, and so that it forms equal angles with each.—Fr. Pat., No. 350,004, June 20, 1904; "B.J.," Mar. 9, 1906, p. 190.

Colour Photography without Filters.—The Drac method briefly described in "B.J.A.," 1906, p. 853, was demonstrated privately in London during February and March, 1906. The apparatus (Eng. Pat. No. 1,008, 1904) provides for the dissection of the spectrum, permitting of the adjustment of the composition and strength of each section to the sensitiveness of the plate so as to obtain the same time of exposure for all three negatives. The apparatus is employed both for the making of the colour-sensation negatives and for the viewing or projection of colour records by additive synthesis. For the latter purpose the positive transparency from the triple negative is placed in the position occupied by the plate, and thus a system of direct colour photography is available in which no coloured means of any kind are used.—"B.J.," Feb. 2, 1906, p. 87.

A later patent of Drac's (Eng. Pat. No. 9,449, 1905) describes modifications in the system of prisms whereby fewer glasses are needed. Drawings, etc., are given in "B.J.," Feb. 9, 1906, p. 111.

PLATES AND FILTERS.

Gradation in Three-Colour Negatives.—Dr. E. Stenger has tested various orthochromatic plates as to the similarity of gradation behind red, green, and violet filters, as used for trichromatic work. Numerous tables and curves are given, and the paper, as a whole, does not admit of useful abstraction, but the author concludes that the characteristic curve under each filter is almost equal and parallel for all three plates.—"Zeit. für Repro.," March-April, 1906.

Plates for Three-Colour.—Sir Wm. Abney describes his method of determining the sensitiveness curve of the ideal plate for three-colour work, and uses for this purpose his well-known method of measuring the luminosities. He takes three spectrum strips, near the blue lithium line, the green magnesium line, and the red lithium line, mixes them in various proportions and then describes the percentage composition of each colour in terms of the three standard strips Then this is multiplied by the luminosity of the same colour in the spectrum, and three curves are obtained which give the luminosity curve of the spectrum. The green and red curves will be approximately of the same height, but the blue will be very flat; but as, when dealing with photographic transparencies, the highest luminosity must be bare glass, it is obvious that the highest densities in each plate must give total transparency, and therefore the curves must

be of the same height. In the following table the first column gives the scale number of the prismatic spectrum, the second the visual luminosity of the colours, the third marked "per cent. composition" gives the percentage of each scale number light in the three curves. The fourth gives the luminosity of these colours in each curve, whilst the fifth set gives the luminosities evened up to a maximum of 100, and then the last column, which is obtained by adding the luminosities of the three curves together, will give the opacity curve of a perfect plate. In the scale attached to the prismatic spectroscope the following figures are the positions of the well-known lines:— B 61.3, red lithium Li 59.7, C 58.1, D 50.6, E 39.8, green magnesium 37.7, F. 30.05, blue lithium 22.8, G. 11.2.

Scale No.	Luminosity of Spectrum.	% Composition.			Luminosity of Colours in the Spectrum.			Last column's curves raised to maximum of 100.			Ideal Plate of last three columns added together.
		R	G	B	R	G	B	R	G	B	
62	2	100	...	...	2	...	...	3·7	...	...	3·7
60	7	100	...	...	7·0	...	...	11·6	0	...	11·6
58	21	97	3	..	20·4	·6	...	38	.98	...	39
56	50	86·8	13·2	...	43·4	6·6	...	72·6	10·5	...	83
54	80	74·7	25·3	...	59 76	20·24	...	99·1	32·1	...	131·2
52	96	62	38	...	59 5	36·5	...	99·0	58·0	...	157·0
50	100	48 2	51·8	...	48·2	51·8	...	80·3	82	...	162·3
48	97	37·6	62·4	..	36 5	60·5	...	60·1	96	...	156·1
46	87	28·2	71·8	...	24·5	62·5	...	40·8	99	...	139·8
44	75	21	79	...	15·7	59 3	...	26·1	94·3	...	120·3
42	62·5	14	86	...	8·75	53·75	...	14·6	85·7	...	100 3
40	50	7·6	92·4	...	3·8	46·7	...	6·3	74·3	...	80·6
38	36	4	96	...	1·44	34·5	...	2·4	54 7	..	57·1
36	24	...	99·5	·55	...	23·66	·13	...	37·5	13 2	50·7
34	14·2	...	98·05	1·95	...	13·9	·28	...	22	28·0	50·0
32	8·5	...	95·74	4·26	...	8·13	·36	...	13	36·0	49·0
30	5·7	...	92·57	7·43	...	5·27	·43	...	8·4	43·0	51·4
28	4·0	...	88·4	12·6	...	3 53	·50	...	5·6	50	55·6
26	2·8	...	74·1	25·9	...	2·07	·73	...	3·2	73	76·2
24	1·95	...	53·2	46·8	...	1·04	·91	...	1 7	91	92·7
22	1·4	...	27·6	72·4	...	·386	1·00	...	·63	100	100·6
20	1·1	...	14	86	...	·154	·946	...	·25	94·6	94·8
18	·86	...	9·6	90·4	..	·073	·787	...	·12	78.7	78·8
16	·76	...	7·0	93	...	·056	·644	..	·09	64·4	64·5
14	·56	...	4·7	95·3	...	·026	·534	...	·04	53·4	53·5
12	·45	...	...	...	...	...	·445	...	...	45	45·0
10	·34	...	...	...	...	..	·340	...	...	34	34
8	·26	...	...	...	...	...	·260	...	...	26	26
6	·18	...	...	...	...	...	·18	...	...	18	18
4	·12	...	...	...	...	...	·12	...	...	12	12

From the table given above it is easy to describe the colour of the screens. That for the red should have a colour which corresponds to an orange, which matches that at 51.6 of the scale of the spectrum, or a little redder than the sodium D light. That for the green would have a colour corresponding to a green at 37.5 on the scale, but it would be a pale green, and could be matched with 32 per cent.

of the green at scale No.37.5, to which 68 per cent. of white light had been added. The screen for the blue would have the colour of the blue lithium line of the spectrum—that is, it would be matched at scale No. 22.6.—"Phot.," Dec. 26, 1905, p. 522.

Hans Schmidt states that panchromatic plates on keeping give softer results behind the red filter than when fresh, because there is increased red sensitiveness. He objects to the frequently recommended white test object, and strongly recommends a black object, such as a crumpled matt black cloth.

In ordinary monochrome photography, as is well known, we decide whether the negative is correct when a black object appears clear in the negative, but still allows detail to be seen there. Three-colour negatives will be then correctly exposed when the black cloth or the cloths, which appear black through the filters, are clear in the negatives, but are reproduced with good detail. If the negatives in the said places are clear, but do not show details, then they are underexposed. If, on the other hand, the negatives are fully exposed for these parts, then the exposure has been too long. A white test object may, of course, be photographed at the same time as the black one. The former then becomes a good means of determining whether the development is correct. The negatives are then correctly developed, neither too thin nor too dense, when the densest parts of the same are still translucent. He also points out that the ratio of exposures is not always constant, and is dependent on the intensity of the illumination.

A further factor which influences the ratio of exposures is, as already pointed out, the composition of the light. It is a well-known fact in colour photography that in a yellowish light, sunlight, for instance, the orthochromatic action is much greater than in a diffused light. This also applies to exposures through filters. The composition of light is never constant. Days occur on which the light is very rich in red, but poor in blue rays, and so on. Very interesting studies may be made on this subject in the autumn. The author has repeatedly observed that on a day when there was a strong mist the light was very poor in blue and green rays, whilst the red rays in proportion to the others were only slightly reduced.

That the ratio of exposures is also dependent on the position of the studio must also be mentioned. It is a well-known phenomenon that in many studios the light alters considerably in the course of the day. It frequently happens, for instance, that in the morning a very warm light, rich in yellow, is met with, whilst in the afternoon it is very "cold." Since the chemical action of light is not strictly proportional to these changes, the ratio of exposures must alter. If, for instance, the ratio for blue to red is found to be for the morning as 1 : 4, in the afternoon it may be as 1 : 4½.—"Phot. Mitt.," Dec., 1905, p. 369; "B.J.," Dec. 29, 1905, p. 1024.

Dr. König describes generally the principles of three-colour work. The blue filter is the easiest to make, as all that is required is the absorption of the yellow and yellowish-green; even if it transmits up to the E line with short exposures it is satisfactory as this green will not act. The green filter is the most difficult; transmission of the

extreme red is of no moment, as this does not act on the majority of panchromatic plates; but it is essential that the filter dampens the blue and yellow sufficiently to allow the green to act, which is always a weak spot in sensitising. If the blue is damped too much a good deal of red will print in the blue, and thus violet be obtained. If the yellow is damped too much some of the orange will be cut out and will print too red. In practice it is more satisfactory to over-dampen the blue, as pure blue is rarely met with in nature. Were it possible to obtain a permanent blue-green dye with narrow absorption band, the blue could be entirely cut out, as pure blue would be formed by a mixture of greenish blue and blueish red. With the present dyes it is preferable to have the pure blues too red, than the greens a dirty brown. The red filter is the easiest to make; violet, blue, and blue-green must be cut out, and red, yellow, and yellowish-green transmitted.

Spectroscopic tests are not reliable. Two green filters, for instance, which show a distinct difference in absorption, will give with a practical test identical negatives. The same applies to sensitisers. Ethyl-red, which in the spectrogram shows a somewhat fainter minimum in the blue-green than pinachrome, given with a camera test, behind the same green filter with equal exposure, always less density in the green than the latter dye. Hence it is correct to say that pinachrome is one of the best sensitisers for green. Dr. Aarland, notwithstanding the experience proved by our innumerable three-colour negatives, states that plates sensitised with pinachrome leave a good deal to be desired in the green. The best practical test is to expose in one camera behind the one filter plates of the same mother emulsion sensitised with the different dyes. Undoubtedly that dye is the better sensitiser for practical work, which *cæteris paribus* gives with equal exposure the better negative of the two.

Pinacyanol may be useful in certain cases, as it sensitises further into the red, and it does not markedly alter the gradation of the plates. Pinachrome is, however, the best general sensitiser. Reproductions of coloured charts and spectrograms are given to prove the sensitising action of the new dyes.—"Phot. Mitt.," Dec. 1, 1905; "B.J.," Dec. 8, 15, 1905, pp. 964, 985.

Filters

The Red Filter in Three-Colour Work.—T. Thorne Baker points out that the exposure through the red filter is the longest, and that it is very desirable to reduce it as far as possible. Homocol, pinachrome, and pinacyanol bathed plates show a better red sensitiveness than when the dyes are added to the emulsion, but still in these cases there is need of a red filter that cuts the exposure down as much as possible. In order to attain a good reproduction of the blue-green, green, and yellowish-green in the colour print, it is necessary that the transmitted spectrum of the red filter should still contain some green, the luminosity of which appears abruptly cut off at λ 5,750 which, however, with longer exposures, gradually increases till at about λ 4,750 it is completely extinguished. Naturally the latter region will only be faintly reproduced even with longer exposure.

A sheet of glass should be coated with a 5 per cent. solution of gelatine and dried, and then soaked in a solution of

Croceine scarlet R	10 parts.
Tartrazine	0.05 parts.
Water	1,000 parts.

till the requisite degree of staining is obtained. The dye bath must be made up twenty-four hours before use, well shaken, and then filtered twice. The stained plate must be rinsed under the tap, and quickly dried at about 75 deg. Fahr., otherwise the dye will crystallise out. Croceine scarlet R is mde by the Bayer Company, and it permits of very short exposures being given. The author does not however, give any information as to how short the exposure is with any plate.—"Phot. Korr.," April, 1906, p. 167.

Professor Novak gives the following method of making a set of rapid filters, using dyes prepared by Meister Lucius and Brüning:—

Rapid filter green	1.75 gm.
Water	1.50 cc.

To 100 ccs. of a 6 per cent. solution of gelatine add 20 ccs. of dye and filter; of this dyed gelatine 7 ccs. should be coated on 100 sq. cm. of glass, and two such screens cemented together. The stock solution of dye must be freshly prepared, for if kept it turns brown.

The red filter is prepared as follows:—

Rapid filter red I.	1 gm.
Water	40 ccs.

To 100 ccs. of a 6 per cent. solution of gelatine add 20 ccs. of dye and filter; of this dyed gelatine 7 ccs. should be coated on 100 sq. cm., and two such screens cemented together.

Novak states that these filters approximately transmit 33 per cent. more light than the old König filters, and that the ratio of exposures with a cloudy sky is as 1 : 2 : 2. The splitting up of the colours by the new filters is said to be very satisfactory.—"Phot. Korr.," June, 1906, p. 285.

Coloured Illuminants for Three-Colour Work.—W. Gamble states that the exposure is considerably reduced if an original be illuminated with the necessary coloured light instead of using filters, and that he has devised and patented an electric lamp, in which are two carbons, which can be alternately brought into play. The one gives an orange red light and the other the ordinary violet of the enclosed arc. So far he has not been able to obtain green illumination, though there should be no difficulty in this, considering the number of chemicals which give green lights. The exposure with the orange red carbons is 50 per cent. less than that of the open or enclosed ordinary carbons. The lamp is constructed by Penrose and Co. The author disclaims any originality in the idea, and states that Warnerke recommended coloured illumination many years ago, in a paper before the R.P.S.—"Eder's Jahrbuch," 1906, p. 100.

THREE-COLOUR TRANSPARENCIES.

Sanger-Shepherd Process.—Dr. A. Norman, in giving his experiences of printing and staining the films, said that for development he used a deep porcelain dish, and filled it with water at

105deg. and immersed the film, leaving it quite still for three or four minutes before examining. Plenty of time must be given to let the surface of the emulsion on the film show signs of solution. Directly the top layer of emulsion has given way we lift the film out and lower the temperature of the water to about 85deg., then the film is re-immersed, and if the emulsion continues to dissolve we know that development is proceeding all right. Presently the details are visible more perfectly, but development must be carried on slowly to get the best results. At a later stage, instead of the emulsion running off with a creamy appearance, it will look like milk, and later still the water draining from the film will be very nearly clear. If, then, the image is not fully developed, the temperature must be raised by adding more warm water. It will then be found that the emulsion will again run off the surface till the image is completely developed. If the film is held over some dark surface every detail in the image can be seen. When development is complete the film is placed in a clean hypo solution 1 in 40 until all the white bromide of silver has been dissolved out, when it must be washed in running water for about half an hour and hung up by clips to dry, or it may be stained at once. Dr. Norman preferred, as a rule, to dry the film first.

In preparing to stain up, the first thing was to separate the two impressions, leaving sufficient margin, and in order to distinguish the films a corner should be cut off the one that is to be stained yellow. The two films have now to be stained. The film should be held at the side by a clip and dipped in the dye. It is well to reverse the clip from one side to the other in order to equalise the action of the dye. It is desirable to stain very thoroughly and then wash out the surplus. If the lighter details become too weak in the washing it is of no importance; a second immersion in a weaker solution of dye will restore these fine details. In making up the slide the first film should be $\frac{1}{8}$in. narrower than the blue slide, and the second film should be one-eighth narrower than the first film. The films being placed in register and held together with clips, these margins must be roughened with a pointed instrument, so that the gummed strip of paper which holds all together may adhere firmly. Out of 200 negatives, Dr. Norman said he had only one which would not register, and felt sure that in that case it was due to under-exposure in one of the negatives.—"Phot. Journ.," June, 1906, p. 212.

The Pre-dyeing Method.—E. T. Butler gives some further notes on one-exposure three-colour work, and on dyeing the three monochromes ("B.J.A.," 1906, p. 855 and 864). For printing the positives, thin glass plates coated with gelatine and subsequently dyed to a standard in an appropriate aniline dye are used. They are sensitised by immersion for three minutes in a 4 per cent. solution of potassium bichromate, and dried quickly in the dark. The colour of each positive plate is complementary to the taking colours of its respective negative.

The negative taken through the red screen is printed on blue-stained gelatine-coated thin glass, though greater sharpness is given if a black tone positive be converted to a blue by bleaching

in potassium ferricyanide and treating the bleached image with ferric chloride.

The negative taken through the green screen is printed on pink-stained gelatine, while the negative taken through the blue screen is printed on yellow-stained gelatine, with which the respective plates are coated.

Each positive should be printed so that the gradient is the same in each. The positive plates are placed with the back next to the face of the negative, and printed through the back of the glass. It is advisable to expose the printing frames in short tunnels to cut off side light.

If prints are made in direct sunlight, the face of the plates should be at right angles to the axis of light. In developing the prints, they should be washed for a few minutes in cold water to dissolve out the sensitiser. They should then be allowed to remain without rocking in hot water about 100deg. to 120deg., which dissolves the unaltered gelatine, and leaves the image in colour. When sufficiently developed they are set in cold water.

Having made sure that the relative strength of colour on each is properly adjusted to the other two by re-dyeing or washing-out, when it is necessary, the elements are allowed to dry, and are then put together.

Glass plates are preferred to films, as easier to manipulate at each stage of the process—namely, in staining, sensitising, printing, developing, and registering. The slide or transparency is made by simply putting the blue and red prints face to face, and the yellow print with the face towards the back of the red, the whole being held together temporarily with clips until the corners are fixed with adhesive and the edges bound.—"B.J.," Feb. 23, 1906, p. 143.

Pinatype Transparencies.—Dr. König suggests the following methods of further utilising the principle of pinatype. Coloured transparencies may be obtained by printing from a transparency on to bichromated gelatine plates, which may either be useless dry plates thoroughly fixed and washed and then sensitised in a 2 per cent. solution of bichromate, or glass may be coated with:

Hard gelatine	240 grs.	50 gms.
Water	10 ozs.	1,000 ccs.
Potassium or ammonium bichromate...	96 grs.	20 gms.

allowing from 68 to 84 minims to every 16 square inches. When dry, the plate should be exposed under a transparency, an actinometer being used to determine the duration of printing, though the speed of the plates is about the same as P.O.P. After exposure, the plate should be well washed and then stained up in a 2 per cent. solution of a pinatype dye. These can be obtained in black-brown, olive-green, bright green, dark blue, and also blue F and red F, these latter being the colours used for the pinatype three-colour process. As soon as the transparencies are sufficiently stained they can be either rinsed and dried, or else treated to a fixative bath of weak copper sulphate solution, and this gives a greater range of colours. The dyes are perfectly stable to light.

By squeegeeing these dyed plates on to gelatinised paper, which may be either of plain, matt, or rough surface, the gelatine will absorb the dye, and the prints can hardly be distinguished from carbon prints.

Reversed negatives can also be made by printing from the original negative on to bichromated gelatine and then staining up after exposure and washing in the black-brown dye, which turns black when treated with the fixative. By printing from this reversed negative again another correct negative is obtained, so that by under or over exposure it would be possible to correct a too soft or too hard negative.—"B.J." (from "Phot. Mitt."), Mar. 30, 1906, p. 246.

Working instructions for the making of transparencies by the pinatype process (applicable equally to monochrome transparencies) are given in "B.J.," Jan. 5, 1906, p. 6.

C. L. A. Brasseur has patented methods of making trichromes on glass or line-colour screens so as to (1) avoid staining of one image by another; (2) produce screens of finer ruling; (3) produce a screen firmly built together with absence of air-bubbles, blisters, etc.; and (4) make the screen so that the outer surfaces of the coloured portions are in the same plane or at one level. The glass is coated with a substratum such as water-glass, and a layer of coloured gelatine applied either in the coloured state or uncoloured for subsequent dyeing. The coloured gelatine film prepared in either way is sensitised in a bichromate bath, printed, and developed. For the second and third monochromes it is most important that the colour be inserted into the film before development, but for the first it will answer as well whether put in before sensitising and printing or before or after development. It is preferable, however, to colour the gelatine from the start, and to print from the negative or line-screen. In the latter case, the engraved or ruled side of a half-tone screen, having a patterned area containing white or transparent spaces one-half as wide as the opaque spaces, is laid against the sensitised side of the film, and the printing done through the white areas. In either case, the image lies in an area or areas of the coloured gelatine film determined by the nature of the stopping-out medium, whether a photographic negative or a line-screen.—Eng. Pat. No. 21,210, 1904 ("B.J.," Nov. 3, 1905, p. 873, where lengthy extracts from the patent are given).

THREE-COLOUR PROCESSES ON PAPER.

Pigments for Three-Colour.—A. J. Newton explains the theory of three-colour printing and the relation of printing colour to light-filter. In measuring colours for the purpose, two spectra are produced side by side, one from a white surface—for example, the paper on which the pigment is intended to be spread—the other the spectrum reflected from the pigment after being put in full strength on part of the same surface. The spectra are compared in small strips for every 100 A.U., the lighter one—that is, the one reflected from the white surface—being cut down by crossed Nicol prisms until it

exactly matches the patch reflected from the pigment itself. The amount by which it has to be cut down represents the amount of absorption, and can be shown graphically by a curve, the ordinates of which represents percentages of the light reflected, that which is not reflected being absorbed; the abscissæ represent the wave length of the spectrum. The angle at which the pigment is viewed is so adjusted that the surface reflection is at a minimum. The author gives curves showing the very great departure of the best commercial sets of colours from ideal properties.—"B.J.," May 25, 1906, p. 406.

Three-Colour Filters and Inks.—L. Geisler describes with figures his method of testing the filters for three-colour work by means of a sector rapidly revolving in front of the plates, the light passing through the filters. The colour-top method of testing three-colour inks is also described.—"Procédé," Aug., 1906, p. 120; "B.J.," Aug. 24, 1906, p. 668.

Stability of Aniline Dyes. — E. Valenta records the results of experiments on a large number of dyes as regards their permanency, the dyes being exposed in thin and thicker films to ascertain their behaviour in the highlights and shadows of three-colour halftone prints.—"B.J." (from "Chem. Zeit."), Sept. 28, 1906, p. 770.

Carbon Three-Colour Prints. — The Autotype Company give the following directions for making three-colour prints on their special yellow, red and blue tissues, by double transfer:—The tissues, yellow, red and blue are sensitised, dried and printed in the ordinary way, the negatives being provided with safe edges.

The exposure differs somewhat from the ordinary carbon printing, and as the negatives are usually very thin, the exposure is rapid. In our experience we have found the following to be the approximate ratio of exposure:—Blue, 2; red, 3; and yellow, 8.

After exposure the prints are squeegeed on special semi-transparent temporary support, and developed in water of about 95 degrees to 100 degrees Fahr. After development they are rinsed in cold water and hung up to dry.

The most suitable support for the final transfer of the prints has from experience been found to be ordinary single transfer paper. The pieces of this it is intended to use should be placed in cold water for about half-an-hour, and then immediately before use into hot water about 140 degrees Fahr. for about quarter of an hour. When ready, take a sheet of this paper and place in a dish of cold water and immerse the yellow print at the same time. Place the yellow print face to face with the transfer paper under water, lift both out together, and hang up to dry. It is not necessary to use a squeegee. When the print has become dry raise the support at one corner with a pin or sharp knife, and then run a paper knife between the two to separate them. The yellow print having been successfully transferred the next step is taken with the red one.

Before attempting to transfer the red print, it is necessary to remove from the yellow print every trace of the waxing solution. This is done by rubbing the print over with a piece of rag wetted with benzole and a little tripoli or whiting. Both the red and blue prints are

transferred in the same manner, but a transfer solution (see below) is required to ensure adherence.

The yellow print resting on its final support is immersed in clean cold water, and, when flat, is laid in the transfer solution face upwards. Soak the red print in cold water and place that also in the solution face downwards upon the yellow print, avoiding air-bells. Lift both out together and lay them upon a sheet of glass. The semi-transparent nature of the temporary support allows the prints to be easily examined by transmitted light, and the registration of the superimposed images is easily effected. The images resting on the glass are now stood on one side to drain, the two being then detached from the glass and hung up to dry.

The transfer of the third or blue print is accomplished in exactly the same manner, including the treatment with benzole, etc.

No alum or other hardening substance should be used until the final print has been transferred, then the compound picture may be placed in a very weak solution of formaline.

Absolute accuracy of registration is facilitated by placing on the negatives at diagonal points two tiny black dots, which will appear white in the resulting prints. These white spots are pierced with a needle on the dry prints and brought together during the transfers. If they fit together accurately, it may be assumed that the registration is correct.

The transfer solution is compounded as follows:—Nelson's No. 1 cut gelatine, 1 oz. to 60 oz. of water. It is strained before use and employed at a temperature not over 90 degrees Fahr.—"B.J.," Feb. 9, 1906, p. 105.

[This process has since been superseded by the method given in the editorial article.—Ed. "B.J.A."]

"Solgram" Colour Prints.—This alleged novel process of colour-photography, due to a Mr. W. C. South, of Downingtown, Pa., U.S.A., is severely criticised in "B.J.," Feb. 2, 1906, p. 88. It appears to be nothing more than the superposition of gum-prints on a ferro-prussiate image.

Rev. Johnson Barker applies red and yellow gum-bichromate coatings to an image in ferro-prussiate.—"Focus," Nov. 8 and Nov. 15, 1905, p. 412 and 432; "B.J.," Dec. 1, 1905, p. 940.

Pinatype Prints.—Leon Vidal gives full details for the making of paper prints by the Pinatype transparency process.—"B.J.," May 18, 1906, p. 390.

For C. L. A. Brasseur's patent for obtaining positives from Sampolo-Brasseur negatives (Eng. Pat., No. 8,290, 1896), see Eng. Pat., No. 15,185, 1906; "B.J.," Aug. 24, 1906, p. 674.

THE DIFFRACTION PROCESS.

Herbert E. Ives (son of F. E. Ives), in examination of the Wood diffraction process ("B.J.A.," 1900, p. 830; and 1901, p. 829), finds that it is erratic, in consequence of the fact that the three gratings, when superimposed, do not act as separate gratings. A new compound

grating is formed by two of the replicas getting in and out of step with each other, and this new grating forms a spectrum of its own. In order to avoid the disturbing effects of superimposition, Ives arranges the gratings in strips, applying the principle of Joly's process to the diffraction method. The improved plan is as follows:—

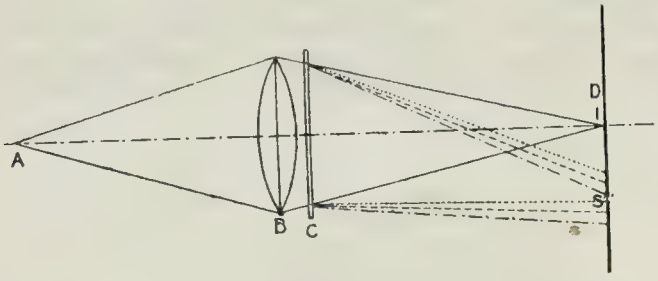


Fig. 1.

In Fig. 1, A is the bichromated gelatine plate rigidly fixed in position; B is a glass diffraction grating; C is a line screen, ruled with at least two hundred lines to the inch, with the opaque lines twice the width of the transparent; and D a lens, and E a positive colour-record to be copied. The latter is an ordinary set of three positives containing no lines or structure, and the grating is an ordinary continuously-ruled one. With, say, the red record at E, and the corresponding grating at B, an exposure is made, resulting in a series of narrow strips. A second positive is then placed at E, the corresponding grating at B, and the ruling C moved the width of a transparent portion. A second exposure is then made, the opaque lines shielding the previously exposed surface, and a similar treatment given to the third positive. There results finally a picture made up of alternating strips of three different gratings.

To eliminate the grating effects of the narrow strips of gratings considered as lines, the device is used of making the strips (Joly lines) run at right angles to the diffraction grating lines, so that the spectra produced by them are thrown off in another direction and do not enter the eye.

Fig. 2 gives an idea of the appearance of the finished picture under the microscope. The short, fine lines are the diffraction grating lines furnishing the three primary colours; 2,400 to the inch for the red, 3,000 for the green, and 3,600 for the blue.

When viewed with a lens and bright source of light the pictures made in this way are entirely free from the formerly-obtained defects. The colours are pure and brilliant, and, unlike ordinary Joly pictures, the colour-lines are too fine to be visible. The results, indeed, approach those obtained with the Kromskop.

As a further modification of the original method the writer has found it possible to dispense with three gratings and obtain the colours with a single grating spacing properly used. To do this the

source of light must be a rather long slit. Viewed through a grating the slit, of course, gives long spectra parallel to its length. If now the grating be rotated about the perpendicular dropped from it to the slit, the spectra move in toward the slit. [The accompanying shift parallel to the length of the slit is compensated for by the slit being long.] So, by suitable rotation any desired spectrum colour may be obtained at a chosen point. Starting with a grating of 3,600 lines to the inch to give the blue when parallel to the slit, a rotation of about 21½ degrees will give the green, of 42 degrees the red. In the absence of suitable dividing engines to rule three properly-proportioned gratings this affords an exact and easy method of securing

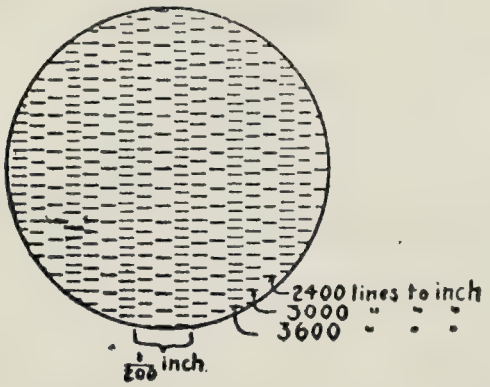


Fig. 2.

the three colours. It has the fourth advantage, that in printing copies such difficulties as securing perfect printing contact will affect all three colours alike, which is not the case with gratings of different degrees of fineness.

Fig. 3 shows a portion of a picture made in this way with one grating spacing.

Mr. F. E. Ives has devised the following instrument for viewing the pictures:—

Fig. 4 gives the instrument in section. A, B, C, D are the four slits; M a mirror; L_1 and L_2 lenses; P the diffraction picture; and S the slit through which the picture is observed. The lenses, of course, form an image of each slit at A^1, B^1, C^1, D^1; from each of these images, however, a certain amount of light is diffracted by the picture P; from B and C first order spectra fall on S, from A and D, second order. The use of second as well as first order spectra is a distinct advantage in that, as gratings never give a perfectly uniform distribution of light and colour, certain desirable qualities of the picture are found in one order and not in the other, while if both

orders are used the resultant evening up of qualities produces particularly satisfactory results.

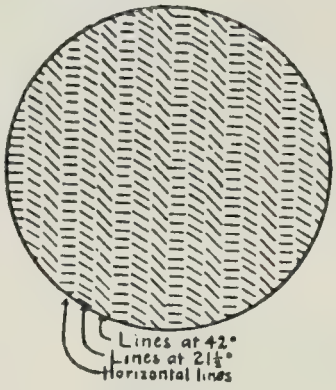


Fig. 3.

By disposing the grating lines in a horizontal direction and using horizontal slits are sources, the pictures may be viewed by both eyes, a desirable condition for convenience and comfort. To use, it is

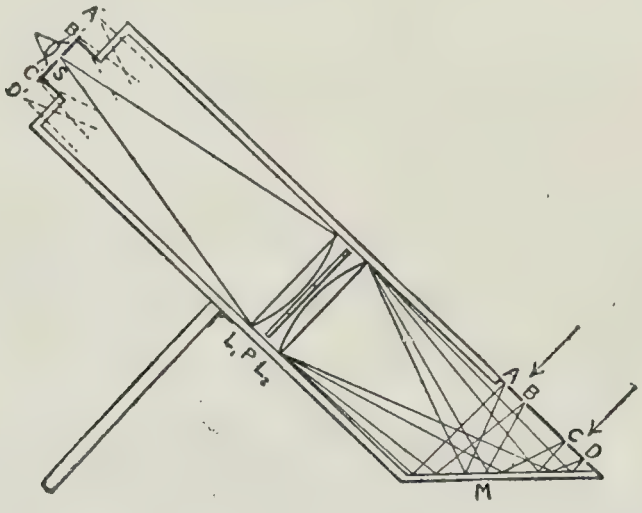


Fig. 4.

merely placed before a window or Welsbach light and the pictures dropped to place.—"B.J." (from "Journal of Franklin Institute"), Aug. 3, 1906, p. 609.

ONE-PLATE THREE-COLOUR PROCESSES.

Direct Colour-Photography.—Gabriel Lippmann, in a paper before the Paris Academy of Sciences ("Comptes Rendus," July 30, 1906, p 270), describes the application of the principle of the spectroscope to direct colour-photography. Instead of the single slit of a spectroscope, a series of slits all very close together is used. They are fine transparent lines of a ruled screen of five lines per mm., such as is employed in process work. This screen is fixed to the front of a photographic enlarger, i.e., to a box provided at its extremity with a sensitive plate, and carrying a converging lens at about the plane midway between its two ends. In front of the lens is fixed a prism of small angle, with its edge parallel to the transparent lines of the screen.

The image to be reproduced is projected on the screen, the sensitive plate is developed and put back in place. On illuminating the apparatus with white light an image is seen in colours. Each line of the screen acts as the slit of a spectroscope, and, as the lines are not visible at the distance of distinct vision, the image appears continuous.

It is necessary that the prism fixed in the apparatus shall have an angle so small that each spectrum has a length less than the interlinear space, otherwise the spectra encroach on each other. It is also essential that the photographic plate occupies exactly the same position as during exposure, a condition which is easily fulfilled in the case of solidly constructed apparatus. If the positive is moved in its frame, the colours rapidly change; if it is turned, there is a coloured moirée effect. On bringing the plate back to its original position these effects disappear.

Rapid commercial orthochromatic plates may be used, and the exposure is much shorter than in the interference process.

It will perhaps be possible to improve this process so as to avoid the use of an apparatus to observe the colours, and to make the plate sufficient in itself.

Suppose that a sensitive plate be placed in an ordinary camera, without a prism, but with the interposition of a ruled screen, and suppose that on the screen (which, we will say, has 5 lines per mm.) we superpose a grating of 500 lines per mm.; each luminous point thus projected on to the screen then spreads as a spectrum, and is photographed. On applying the screen, with its grating, to the developed positive, we should see the colours of the original—that is to say, if the eye can occupy the place of the lens.—"B.J.," Aug. 17, 1906, p. 614.

The Lumière Starch Grain Process.—In continuance of their patents ("B.J.A.," 1906, p. 862), the Lumières now fill up the interstices in the coloured starch grain coating not with finely divided charcoal, but by subjecting the coating to rolling pressure, after the grains have been brought to a proper condition of dampness.—Eng. Pat., 18,422, 1905; "B.J.," Aug. 17, 1906, p. 654.

The Powrie Process.—John H. Powrie describes the screen by which direct-photographs in colour are obtained at one exposure in an ordinary camera by a modification of the Joly process. ("B.J.A.,"

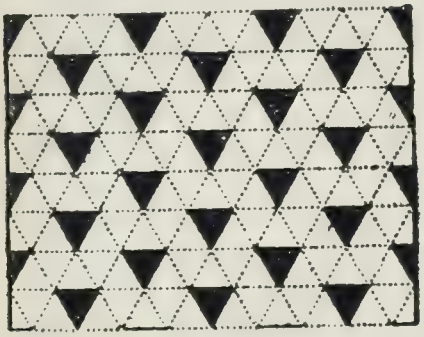
1906, p. 863). A banded filter is made on a glass plate by coating with bichromated gelatine and printing from a line pattern or stencil of opaque bands which are double the width of the intervening clear line, and finally staining with the required colour. This process is repeated three times altogether to produce the three interspersed series of colour bands, and the screen is then used as a separate filter in contact with a plate, or an emulsion coated on it and exposure made through the glass.

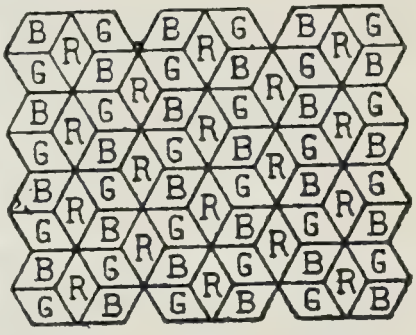
For hardening the gelatine after each staining operation a bath is used, containing about one pound of tannic acid in a gallon of water. —Eng. Pat., No. 20,662, 1905; "B.J.," June 8, 1906, p. 454.

An account of the Powrie-Warner process appears in "Penrose's Pictorial Annual, 1905-6," and is reprinted in "B.J.," Dec. 29, 1905, p. 1029.

One-Exposure Filter Screens.—Dr. J. H. Smith patents different patterns of screens, consisting of three sets of colour filters, distributed geometrically throughout the area of the screen as triangles, hexagons or rhombuses, and so arranged that at every point where these unit areas meet all the colours in the screen are represented once or several times.

If the screened surface is upon a glass or other transparent support, the screen can be used placed face to face upon a suitably prepared





colour-sensitive plate for taking a negative, or for viewing in colours the positive copied from such a negative. When the screened surface is required upon paper or similar material upon which printed impressions may be made, a screened relief surface may be employed for the production of polychrome prints by means of a photo-mechanical process.

The method of printing on film may be the same as that for printing on paper. In the case of glass, Dr. Smith advocates the following process:—A suitably reduced and sharp negative is taken upon a sensitive plate. From this negative three positives are printed upon bichromated gelatine surfaces, one of the gelatine supports being glass, the other two celluloid or collodion films. After washing out the soluble gelatine the positives are coloured in suitable solutions, e.g., one in red, the second in yellow-green, and the third in violet-blue colour. The celluloid or collodion films are then laid upon the

glass plate, and, by means of a magnifying glass, brought into register so that the colours are regularly distributed. In this position the films are cemented securely upon the glass plate, e.g., with Canada balsam, and the whole forms the taking screen, which in taking a negative is placed upon a panchromatic plate, the screen surface being towards the plate. From the resulting negative a positive is made, and this positive is viewed through a similar colour screen in the corresponding colours, whereby the photograph appears in natural colours.—Eng. Pat., No. 6881, 1906; "B.J.," June 22, 1906, p. 494.

Captain W. Lascelles-Davidson has patented a process for producing natural-colour prints from negatives taken in the ordinary way through a screen. In this negative:—

White should be opaque.
Blue should be semi-opaque.
Green should be middle density.
Yellow should be middle density.
Red should be faint density.
Black should be clear glass.

A red positive is first made by any known colour process printed from the negative, taking care that only the clear portions of the negative (representing black) and the most faint density (representing the reds) only are printed. This red positive (from the second operation) is registered in close contact with the same negative, and a fresh positive is printed again in yellow or green (by any known colour process) on another surface until the middle density only is printed. A red positive is made first, and then superimposed on the same negative before printing the next colour (yellow or green), because the red positive is required to act as a light shield, so that it will block out the red density in the negative and prevent it from printing again on the next colour, unless the colours happen to blend, when, of course, the gradation and density of the negative will step in and give the required impure or mixed colour or colours. We now have a red and yellow (or green) positive, each picking out its own colour and mixture of colours. We have simply to superimpose the red and yellow (or green) positives on each other and place them in register with the same negative, and print the next density (blue) by any known colour process in blue, the red and yellow (or green positive) serving as light shields to prevent other densities from printing in the wrong colour. We shall have now three positives in red, blue, and yellow (or green) respectively, each positive picking out its own colour according to the density of the negative, and to make a picture from the negative as true as possible in colour to the original scene. We print (without any positive shield or shields) a light monochrome positive in black from the same negative (to give black in clear portion of negative), and when we superimpose and register the red, yellow (or green), and blue positives (or in any suitable order or degree of colour) on the monochrome positive the picture will be a complete triad of colour, the monochrome print giving the black, and the red, blue, and yellow (or green) positive giving all the other colours and mixture of colours when registered and superimposed on each

other. Alternative methods of carrying out the same idea of the light-shield by photographic and photo-mechanical processes are described.—Eng. Pat., No. 16,104, 1905; "B.J.," Sept. 7, 1906, p. 711.

Colour Screens.—C. L. A. Brasseur has patented certain forms of ruled colour screen designed to indicate variations in colour-sensitiveness on exposure of a plate.—Eng. Pat., No. 12,793, 1906; "B.J.," Aug. 24, 1906, p. 674.

TWO AND FOUR-COLOUR PROCESSES.

A Two-Colour Printing Process of J. K. Henberger consists in coating an ordinary piece of silver chloride printing paper with a film of indiarubber, and to this applying a coat of gelatine. The negative to be printed yellow is made reversed, laid on the gelatine film of the paper, and exposure made as for silver paper. The print is washed in cold water for about half an hour, and is then given its yellow colour without drying by means of a 25 per cent. aqueous ammonia solution. The yellowing takes place through the uncoated paper (the back of the print), the print being fixed in frame and protected at the edges with strips of paper while the ammonia is applied. The action takes place in a few minutes; the print is then washed and dried. The gelatine surface is now sensitised with a ferro-prussiate mixture, and an image in Prussian blue obtained through the second negative.—Ger Pat., No. 171,072, 1905; "Phot Ind.," Aug. 22, 1906, p. 850.

Two-Colour Process.—The Chemische Fabrik auf Aktien, vormals Schering, have patented a method for preparing printing material for Gurtner's two-colour process of colour photography, for which two negatives are taken; one through a violet, and the other through an orange, filter. From the yellow negative a print is taken on P.O.P. and fixed with ammonia, which gives a yellow image. From the blue negative a positive is made on a chloro-bromide emulsion coated on celluloid, so that it can be stripped; this being the essential point of the patent. This black positive is then converted into a blue image by treatment with ammonia-citrate of iron 0.5 parts, glacial acetic acid 50 parts, potassium ferricyanide 0.5 parts, water 200 parts. The blue positive is then washed in acidulated water and superimposed on the yellow image, dried, and the celluloid stripped. —Ger. Pat., No. 169,313, May 4, 1905.

Four-Colour.

The Zander Four-Colour Process.—C. G. Zander bases a process of reproduction in colours on a theory of four fundamental colours—viz., red, yellow, green, and blue, by mixtures of which in suitable proportions any colours in nature can be matched or reproduced. The hues of these four fundamental (or monochromatic) colours, red,

yellow, green, and blue may in popular terms be approximately described as follows:—

Magenta red, Emerald green, and
Lemon yellow, Ultramarine blue.

It will be found that magenta red (we use this name for the lack of a more scientific one) is one of the constituent colours of spectrum red (magenta red + yellow), and also of spectrum violet (magenta red + blue).

The four fundamental colours can be grouped into two pairs of complementary colours, viz.:—

Red and green,
Yellow and blue,

so that when the elements of either pair are mechanically mixed as pigments, by printing or staining, they produce black, while the effect of their optical combination, produces the sensation of white light.—"Penrose's Pictorial Annual," 1905-6, p. 9.

The allowable variation in the four fundamental colours and the spectral position of the preferred colours are best expressed by reference to their wave lengths. Thus for the yellow may be used any or all of the hues having wave-lengths between 6,000 and 5,600; for green, any or all of the hues having wave-lengths between 5,500 and 5,000; for blue, any or all of the hues having wave-lengths between 4,900 and 4,200; while the limits of the red are defined by the complementary colour of any or all of the hues of spectrum green between wave-lengths 5,500 and 5,000. The preferred hues may similarly be defined to those corresponding to wave-lengths 5,890 (about D line), 5,220 (about E½ *b*), and 4,580 (about F½ G), together with the colour complementary to that of wave-length 5,220.

It is advisable in these colour records that there should be overlapping in the green and red records in the region both of the D and of the G lines, and in the yellow and blue records in the region of the lines E and *b*. These overlappings, the extent of which is discretionary and may be determined empirically, produce corresponding gaps at D, G, and E to *b* in the positives, whereby the production of the yellow, spectrum green and blue respectively may be effected.—Eng. Pat., No. 27,023, 1904; "B.J.," Jan. 5, 1906, p. 14.

Four-Colour Photography.—A. von Hübl, writing on this subject, states that it is impossible to obtain perfectly true results by four printings, because, generally speaking, in each of the three negatives three colours must always act like white and the fourth like black, but this is an impossibility, and the colours will always be degraded by a complementary pair of colours, and will, therefore, appear more impure than in three-colour photography. The theory is correct, but it assumes the ideal printing inks, which do not exist. There is also much more trouble with four-colour photography, and, of course, greater chance of errors and want of register. In spite of the above-described failings of the four-colour process, it does not preclude the fact that it can sometimes give better results than three-colour printing, only there must be considerable fine-etching of the

printing plates. This must be done on all four plates, and is considerably more than is necessary with three-colour work. Without this manual help the process cannot be employed, and for this reason also four-colour photography is valueless for carbon and gum printing.—"Wien. Mitt.," June, 1906, p. 179; "B.J.," Aug. 31, 1906, p. 693.

COLOUR EFFECTS FROM ORDINARY NEGATIVES.

"*Mars-Star*" *Process.*—Captain Lascelles Davidson and Friese Greene have devised this so-called process in which a bromide print is bleached, and after rinsing treated all over with a series of colour washes, which act selectively upon the print. The inventors state that the densities (representing colour in monochrome) should be as nearly as possible as follows:—

White in the original scene should be opaque in the negative.
Blue should be semi-opaque.
Green should be of middle density.
Yellow should be of middle density.
Red should be of faint density.
Black should be of clear glass.

If the red developing compound is applied first only the red and yellow deposits in the print will be affected, and will develop up to a red. The blues and greens will not develop up until a developing compound for such colour is applied to the print, when the colour will be gradually re-developed and built up in the deposit of the print. The highest lights (whites) do not take any colours and wash quite clean, unless the redevelopment has been carried on too far. It is only during the period of redevelopment that a bromide print shows power to select or repel a colour or colours, after which it becomes stained and untrue; but the latitude allowable in procedure before this stage is arrived at is very great.—"Penrose's Pictorial Annual," 1905-6, p. 85; "B.J.," Dec. 29, 1905, p. 1030

KEY TO THE ABBREVIATIONS OF JOURNALS QUOTED IN "EPITOME OF PROGRESS" WITH ADDRESSES OF THOSE PUBLISHED IN FOREIGN COUNTRIES:—

"A.P."	"The Amateur Photographer."
"Amer. Am. Phot."	"The American Amateur Photographer," 361, Broadway, New York City, U.S.A.
"Ann. Gen. Phot."	"Annuaire Général de la Photographie." Plon. Nourrit & Co., 8, Rue Garancière, Paris.
"Ann. Chem. Phys."	"Annales de Chimie et de Physique." Masson & Co., 120, Boulevard St. Germain, Paris.
"Apollo"	"Apollo." Moltkeplatz 10, Dresden A., Germany.
"Atelier"	"Das Atelier." W. Knapp. Halle a/Saale, Germany.
"Aust. Phot. Journ."	"Australian Photographic Journal." Harrington & Co., Ltd., 386, George Street, Sydney, Australia.
"Aust. Phot. Rev."	"Australian Photographic Review." Baker & Rouse Proprietary, Ltd., 375, George Street, Sydney, Australia.
"B. J."	"The British Journal of Photography."
"B. J. A."	"The British Journal Photographic Almanac."
"B M."	"The Bromide Monthly and Photo Notes."
"Berichte"	"Berichte der Deutschen Chemischen Gesellschaft." R. Friedländer & Sohn, Karlstr. 11, Berlin, N.W.
"Bild"	"Das Bild." Neue Photographische Gesellschaft, Steglitz, Berlin.
"Brit. Opt. Journ."	"The British Optical Journal."
"Bull. Belge"	"Bulletin de l'Association Belge de Photographie." M. C. Puttemans, Palais du Midi, Brussels.
"Bull. Fr. Chem. Soc."	"Bulletin of the French Chemical Society." Masson et Cie, 120, Boulevard St. Germain, Paris.
"Bull. Soc. Fr. Phot."	"Bulletin de la Société Française de Photographie." Gautier-Villars & Sons, Quai des Grands-Augustins 55, Paris, France.
"Cam."	"The Camera." 123, S. 11th Street, Philadelphia, Pa. U.S.A.
"Cam. and Dk. Rm."	"Camera and Dark Room." 30, Cortlandt Street, New York, U.S.A.

"Cam. Craft"	"Camera Craft." 819, Market Street, San Francisco, California, U.S.A.
"Cent. Zeit."	"Central Zeitung für Optik und Mechanik." Bülow Str. 7, Berlin, W., Germany.
"Chem. News" ..	"The Chemical News."
"Chem. Zeit."	"Chemiker Zeitung." Dr. G. Krause, Cöthen, Germany.
"Compt. Rend." ..	"Comptes Rendus des Séances de l'Académie des Sciences." Gautier-Villars, Quai des Grands-Augustins 55, Paris.
"D. Phot. Zeit." ..	"Deutsche Photographische Zeitung." K. Schwier, Weimar, Germany.
"Der Amateur." ..	"Der Amateur." 3, Opening, Vienna.
"Der Phot."	"Der Photograph." Benno, Fernbach, Bunzlau, Germany.
"Eder's Jahrbuch" ..	"Jahrbuch für Photographie und Reproduktionstechnik." W. Knapp, Halle a/S., Germany.
"Focus"	"Focus."
"Il Prog. Foto." ..	"Il Progresso Fotografico." R. Namias, 27, Via Boccaccio, Mailand, Italy.
"Journ. Chem. Soc. Trans."	"Journal of the Chemical Society: Transactions."
"Journ. Phot. Soc. Ind."	"Journal of the Photographic Society of India." 40, Chowringhee, Calcutta, India.
"Journ. Roy. Micr. Soc."	"Journal of the Royal Microscopical Society."
"Journ. S. C. I." ..	"Journal of the Society of Chemical Industry."
"Journ. Soc. Arts" ..	"Journal of the Society of Arts."
"Knowledge"	"Knowledge."
"Le Phot."	"Le Photo Journal." 22, Rue Vurenna, Paris.
"Lech. Mitt."	"Lechners Mitteilungen." 41, Graben, Vienna, Austria.
"Mon. Phot."	"Le Moniteur de la Photographie." 7, Rue Scheffer, Paris, France.
"N. Z. Phot."	"Sharland's New Zealand Photographer." Lorne Street, Auckland, N.Z.
"Nature"	"Nature"

"Oest. Phot. Zeit." ..	"Oesterreichische Photographen Zeitung." Oesterreicher Photographen-Verein, Vienna III/I.
"Opt."	"The Optician."
"Opt. Lant."	"The Optical Lantern and Cinematograph Chronicle."
"Pro. and Am. Phot."	"The Professional and Amateur Photographer." 222, Washington Street, Buffalo, U.S.A.
"Proc. Roy. Soc." ..	"Proceedings of the Royal Society."
"Procédé"	"Le Procédé." 150, Boulevard de Montparnasse, Paris XIV.
"Process Pgm." ..	"The Process Photogram." Now "The Photo-Engravers' Monthly."
"P. M."	"The Photo-Miniature." 289, Fourth Avenue, New York, U.S.A.
"P. N."	"The Photographic News."
"Pgm."	"The Photogram' (now "The Photographic Monthly.')
"Pharm. Journ." ..	"The Pharmaceutical Journal."
"Phil. Mag."	"The Philosophical Magazine."
"Phil. Trans." ..	"Philosophical Transactions of the Royal Society."
"Phot."	"Photography."
"Phot Chron." ..	"Photographisches Chronik." W. Knapp, Halle a/Saale, Germany.
"Phot. Couleur." ..	"Les Photographie des Couleurs." 118, Rue d'Assas, Paris
"Phot. Indus." ..	"Die Photographische Industrie." Dresden A., 21, Germany.
"Phot. Journ." ..	"Journal of the Royal Photographic Society of Great Britain" ("The Photographic Journal").
"Phot. Korr."	"Photographisches Korrespondenz." 7, Carmelitergasse, Vienna II.
"Phot. Kunst" ..	"Photographische Kunst." Heustrasse 18, Munich, Germany.
"Phot. Mitt."	"Photographische Mitteilungen." Gustav Schmidt, Königin Augustastr. 28, Berlin, W. 10, Germany.
"Phot. Rund." ..	"Photographische Rundschau." W. Knapp, Halle, a/S. Germany.
"Phot. Scraps" ..	"Photographic Scraps."
"Phot. Times" ..	"The Photographic Times." 39, Union Square, New York City, U.S.A.
"Phot. Welt". . . .	"Photographische Welt" (formerly "Der Amateur Photograph"). M. Eger, 29, Grimmaischer, Steinweg, Leipsic, Germany.
"Phot. Woch."	"Photographisches Wochenblatt." 13, Bendlerstr., Berlin, W.
"Photo-Beacon" ..	"The Photo-Beacon." Security Building, Chicago, Ill., U.S.A.
"Photo-Era"	"Photo-Era." 170, Summer Street, Boston, Mass., U.S.A.

"Photo Gazette" ..	"Le Photo Gazette." 83, Rue Demoures, Paris, France.
"Photogramme" ..	"Le Photogramme." 17, Rue de Mauberge, Paris.
"Photo-Revue" ..	"Photo-Revue." 118, Rue d'Assas, Paris VI, France.
"Photographer" ..	"The Photographer." 21 and 26, East 21st Street, New York, U.S.A.
"Photographie" ..	"La Photographie." 295, Rue St. Jacques, Paris, France.
"Phys. Rev."	"The Physical Review." Ithaca, New York, U.S.A.
"Pract. Phot." ..	"The Practical and Pictorial Photographer."
"Revue des S. Phot." ..	"Revue des Sciences Photographiques." Chas. Mendel, 118. Rue d'Assas, Paris.
"Rev. Phot."	"Revue de Photographie." Photo Club de Paris, 44, Rue des Mathurins, Paris, France.
"Rev. Suisse"	"Revue Suisse de Photographie." 23, Escaliers du Marche, Lausanne, Switzerland.
"Rev Trimest"	"Revue Trimestrielle des Travaux de Récherches." A. Lumière et Ses Fils, Lyons.
"Sci. Amer."	"The Scientific American." Munn & Co., 361, Broadway, New York, U.S.A.
"Sonne"	"Sonne." Kaiser-Platz, 18, Wilmersdorf, Berlin.
"St. L. and C. Phot."	"The St. Louis and Canadian Photographer." 3210, Locust Street, St. Louis, Mo., U.S.A.
"St. Ver."	"Saint Veronica." Dr. Geo. Ewing, Merlin Park, Old Ballygunga, Calcutta, India.
"Wiener F. Photo Zeit."	"Wiener Freie Photographen Zeitung." Gustav Walter, Payergasse 13, II/16 Vienna, Austria XVI/1.
"Wilson's"	"Wilson's Photographic Magazine." 289, Fourth Avenue, New York, U.S.A.
"Yr. Bk. Phot." ..	"The Year Book of Photography."
"Zeit. für Instr." ..	"Zeitschrift für Instrumentenkunde." Julius Springer, Berlin.
"Zeit. für Repro." ..	"Zeitschrift für Reproduktionstechnik." c/o Wilhelm Knapp, Halle a/Saale, Germany.
"Zeit. für Wiss. Phot."	"Zeitschrift für Wissenschäftliche Photographie." J. A. Barth, 17, Refsplatz, Leipsic, Germany.

RECENT NOVELTIES IN APPARATUS, &c.

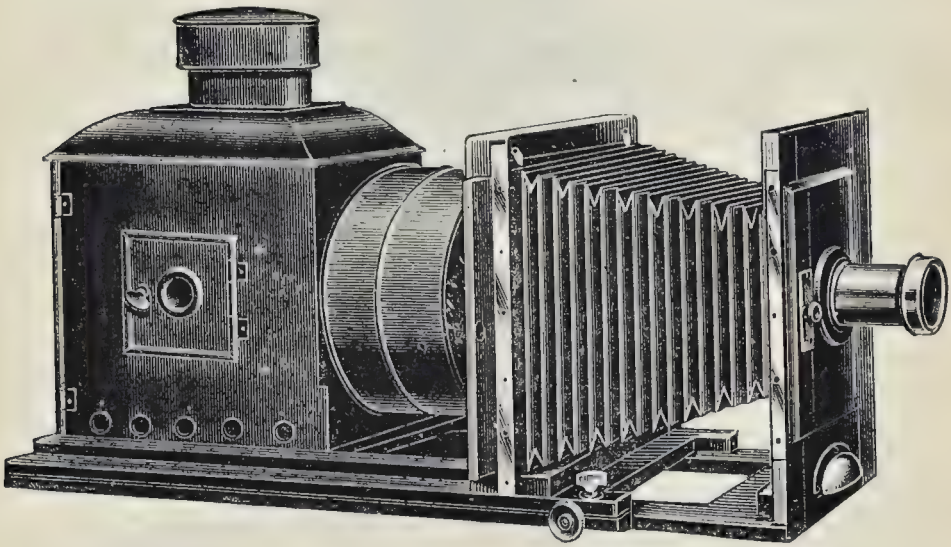
(*Continued from page* 615.)

An index to "Recent Novelties" is given on pages 616 and 617.

ARCHER'S ELECTRIC LANTERN.

(Sold by Archer and Co., 73, Lord Street, Liverpool.)

This apparatus, which is substantially made as the result of the extensive experience of Messrs. Archer as lanternists in the North of England, is intended for every requirement of lantern exhibitions. The bellows body, which is of long extension, is detachable from the lantern body, and is secured to the lens front, so that space



is left for the projection of scientific experiments. The extension is such that the longest focus lenses can be used. The instrument is fitted with 4½ inch condensers, and is of the highest workmanship throughout. The price, without projection lens or light, is £7 10s.

A NEW PLATE AND FILM HOLDER.

(Sold by Ross, Ltd., 3, North Side, Clapham Common, London, S.W.)

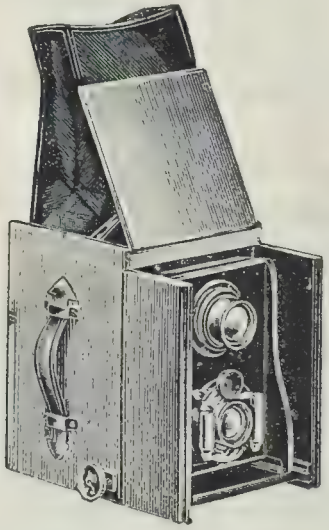
The above is a very compact piece of apparatus for the exposure of plates or cut films, in a special form of light-tight sheath. The total dimensions of the apparatus in quarter-plate size are 6½ in. by 4¼ in. by ⅞ in. thick. Within this bulk a focussing screen and

hood are contained. The apparatus, which evidently provides an efficient method for carrying an unlimited number of plates or films, costs, in quarter-plate size, 16s. The sheaths or envelopes for 5 by 4 or quarter-plate are obtained for 4s. per dozen, or in the half-plate size 6s. The price of the half-plate holder is £1.

THE ROSS TWIN LENS REFLEX CAMERA—NEW MODEL.

(Made by Ross, Ltd., 3, North Side, Clapham Common, London, S.W.)

In the new model of this twin-lens camera the makers have introduced a rotating revolving back, automatically springing into the vertical and horizontal positions. The camera carries focal-plane shutter with time and instantaneous adjustments, and like its predecessor has its bulk reduced to what must surely be the



minimum dimensions for a camera of this type, namely, 6 in. by 6½ in. by 8½ in. in the quarter-plate size.

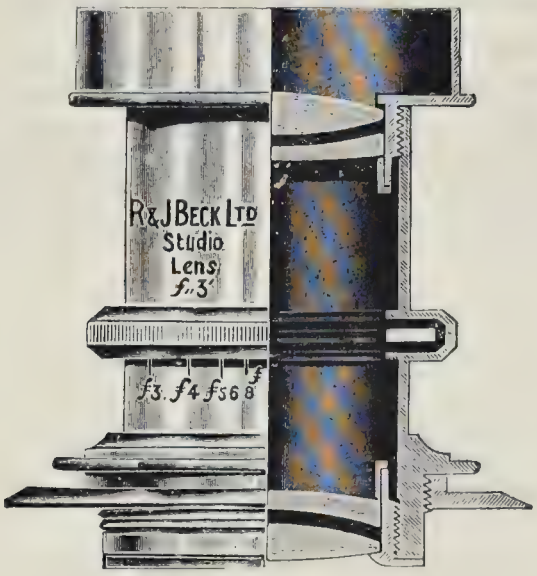
This camera is made in three sizes. The price of the quarter-plate, with three double slides, Koilos shutter, and pair of *f*/6.3 Homocentric lenses, is £15 15s. The price of the half-plate, with square finder and revolving back, and time and instantaneous focal plane shutter, and pair of *f*/6.3 Homocentric lenses, is £27. The same, 5 by 4 size, £22 9s.; quarter-plate size, £19 10s.

THE BECK F/3 STUDIO LENS.

(Made by R. and J. Beck, Ltd., 68, Cornhill, London, E.C.)

Messrs. R. and J. Beck have submitted to us one of their studio lenses, series I., No. 2, of 6 in. focal length and full aperture of *f*/3. This is a non-symmetrical doublet, formed of two uncemented combinations. It covers a circle of about five inches diameter, and should give very good results on any plate under quarter-plate size. The definition in the centre of the plate is excellent, and

at *f*/3 the falling off towards the margins is not nearly so great as we expected to find it. Astigmatism is small in amount, distortion is not apparent, and the field is only slightly concave



towards the object. This should be a very useful instrument for carte-size portraiture. A comparison between this lens and an old Petzval lens of the same focal length shows a most marked superiority in the marginal definition. The new lens at *f*/3 is far superior to the old at *f*/4 in this respect, while in the centre of the image the definition is nearly, if not quite, as good. We need hardly point out that for fine central definition a Petzval portrait lens of the old type cannot well be beaten, and that few modern lenses come up to the same standard. In many cases perfect central definition has to be sacrificed to secure suitable marginal corrections.

THE ALDIS ANASTIGMAT, SERIES II., No. 2A.

(Made by Aldis Bros., Old Grange Road, Sparkhill, Birmingham.)

This lens is of 6.4 in. focal length, and is designed to work at *f*/6.3 when mounted in a Bausch and Lomb 5 by 4 Unicum or Automat shutter. Though included in the well-known Series II. lenses, which work at *f*/6, we understand that the 2A lens is of modified design. It has been produced especially for use in a post-card-size camera, and it should fulfil this purpose excellently, considering that our tests in a half-plate gave most satisfactory results. A trial on a plane test chart showed that it covered a half-plate well at *f*/6.3, and that the definition at the corners was all that could be desired with such a large aperture. A more critical test on a small point of light shows that the astigmatic correction is of a high order, the trace of astigmatism and coma being very slight indeed. It may, perhaps, be as well to note that such traces are

nearly always to be found even with the highest-class lenses, and that such a test as this readily reveals aberration, even when the amount is so small as to be quite negligible in practical work. Tests on normal subjects show that the lens is a most useful article for anything up to half-plate, and, considering its low price, it should be a very popular instrument. When stopped down, it covers a fairly wide angle, and, obviously, it should be useful as a wide angle lens with fairly large plates, though we have not actually tested it on any bigger than a half-plate. The lens is small and very light, weighing in plain brass mount only 3½ oz. Comparing it with another anastigmat of the same aperture and 7 in. focal length (only .6 in. more), we found the difference in weight to be no less than 7¾ oz., or close on ½ lb. Such differences are of considerable importance in lenses designed for rapid work in hand cameras. The price of the 6.4 focus lens is £2 2s. 6d., in iris mount.

A REPEATING BACK.

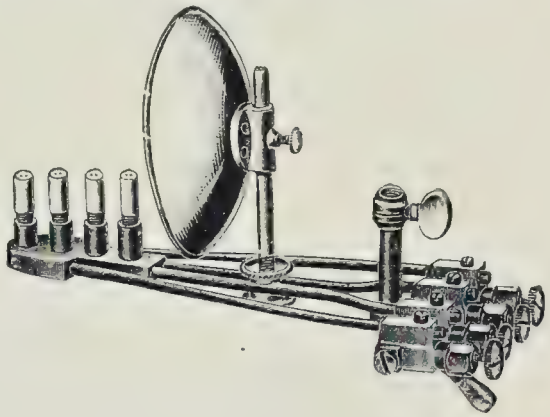
(Sold by the Altrincham Rubber Company, Mossburn Buildings, Altrincham.)

This new rapid back is made for giving four pictures on the quarter-plate, and may be adapted to any camera; costing 22s. 6d. The firm have also a new rapid back for three-colour work, taking and providing for the insertion of three filters in a special rabbet. The price for quarter-plate size is £2 17s. 6d.; for 5 by 4, £3 2s. 6d.; and for half-plate, £3 7s. 6d.

THE MOSS ACETYLENE JET.

(Made by R. J. Moss & Co., 98, Snow Hill, Birmingham.)

There are several features of this jet, which will commend themselves to the worker who knows something about acetylene lighting.



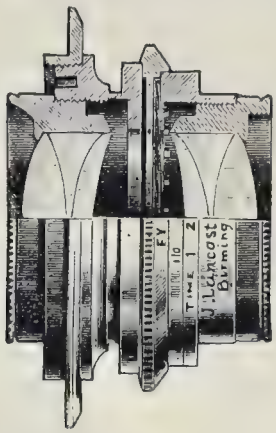
In the first place, the gas enters a chamber before passing through the valve, and the steam and vapour thus have a chance to condense. The screw for the fixing of the reflector is placed above, not below, the jet, and is therefore more accessible. The reflector itself is of white metal, and can be polished and re-polished. The four burners also are slightly stepped, one above another, to avoid any possible blue spot in the light, a minute shifting of the flames in

reference to each other obviating such a phenomenon. The price of the jet is 15s., and it is illustrated by the accompanying block.

THE ANASTIGMAT RECTIGRAPH.

(Sold by J. Lancaster and Son, Limited Colmore Row, Birmingham.)

Messrs. Lancaster have brought out a new model of this lens, consisting of two triple combinations, as shown in the figure. The



lens, in aluminium mount and with Iris diaphragm, is made in two sizes—namely, 5in. and 7in. focus for quarter-plate and half-plate respectively. The prices of these are £3 and £4 10s. respectively.

A PRINTING AND ENLARGING EASEL.

(Sold by Henry Land, 15, Alma Place, Thornbury, Bradford.)

The apparatus, a description of which, on the publication of its patent specification, appeared in the BRITISH JOURNAL OF PHOTOGRAPHY, is designed to facilitate the making of bromide and gaslight prints by contact, and the enlarging on bromide by artificial light. It consists of two frames, one sliding within the other, and each provided at its extremity with a hinged frame, which can be fixed upright to the sliding frames and accommodate a printing frame. At the centre of the uprights, between the two frames, is a platform carrying a gas burner, screened on either side with ground glass, supported in a framework.

Each horizontal frame is divided into inches, so that the distance of either printing frame from the source of light can be instantly adjusted. When using the apparatus for enlarging, an easel is attached to one of the upright frames and the other turned down and employed as the support for a platform on which the enlarging lantern is mounted, the divided scales running the length of the apparatus still serving, as before, for the adjustment of the lantern and easel for any given degree of enlargement. The whole installation, which folds up within a small space, should dispense with any measurements and calculation in the course of the enlarging work done with it. Price, complete with easel and stand for the lantern and with gas burner and ground glass screens, is £2 10s.

THE APTUS FOLDING LANTERN SCREEN.

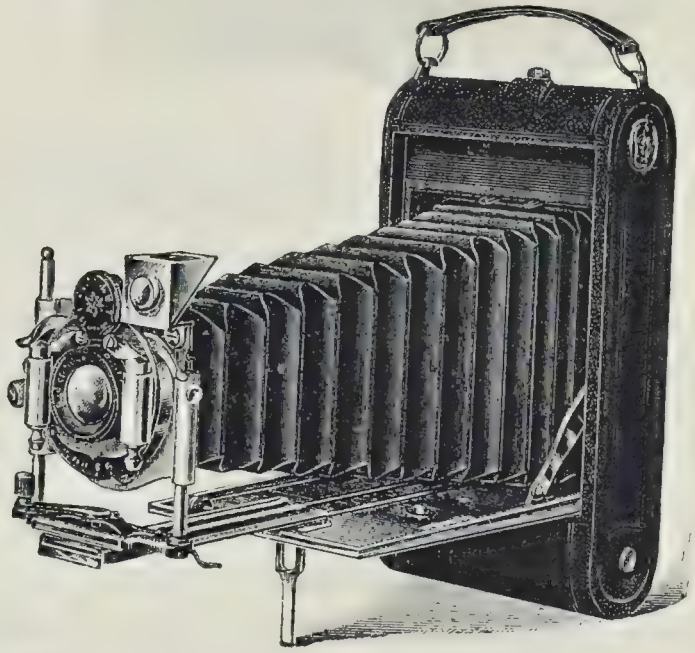
(Sold by Sharp and Hitchmough, 101 and 103, Dale Street, Liverpool.)

A new opaque lantern screen is an introduction of Messrs. Sharp and Hitchmough, which should be valued by lanternists, as the sheet, though coated and opaque, can be folded without the creases being objectionably visible when the screen is erected. The convenience of such a screen, which can thus be carried in the lantern case, should need no recommendation. The screens are made in sizes from 6 feet to 20 feet square, at prices from 15s. to 18s.

THE "TELECAM" AND "POCKAM" CAMERAS.

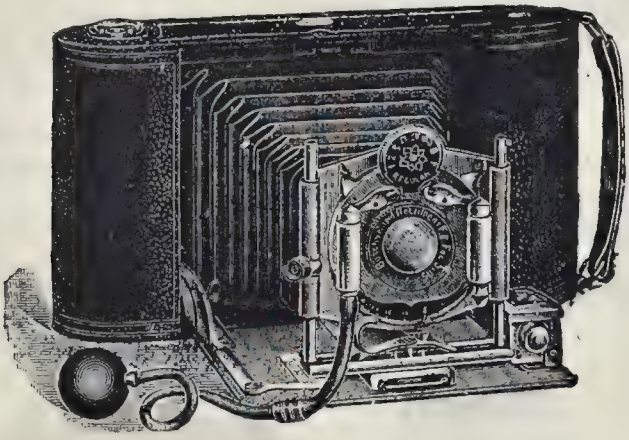
(Sold by the Emil Busch Optical Co., 35, Charles Street, Hatton Garden, London, E.C.)

The "Telecam" camera is of the convenient folding pattern, provided with a back, accommodating both plates and rolled films. The construction of the back allows the use of dark slides for plates without the need of a separate adapter, the groove of the slide



accommodating also a hooded focussing screen. The camera is of long extension, racking to 10¼ inches from plate to diaphragm slot, thus permitting the use of the single combination of the lens.
It is provided with ample rise of front, a Wollensack automatic shutter for time, bulb, and instantaneous exposures, reversible finder, and two bushes. Price, with Busch R.R. lens, £4 4s.; with "Omnar" anastigmat, *f*/7.7, £6 15s. These prices do not include slides and fixing screen, the price of which, three slides and screen, is 8s. 6d.

The "Pockam" camera is, similarly, a quarter-plate apparatus, for roll films and glass plates; the base board, however, is built the opposite way of the plate, the accessories of the camera being, in other respects, similar to the "Telecam," save that the "Pockam"



is a single extension instrument. The price, with Busch R.R., is £3 3s.; with Busch detective aplanat, working at *f*/6, £4 4s. Extra to these prices is a charge of 13s. 6d. for three slides, focussing screen, envelope and adaptor.

For these and other cameras of the same description, the Busch Optical Company supplies a flexible purse, carrying six single dark slides. The purse, which is sold under the appropriate name of the "Wafer," measures 5 by 5½ inches, and is strongly made in black grained leatherette. It is made to carry slides of both horizontal and vertical form, the price for each pattern being 3s. 6d. respectively.

THE NEW RUBRALUX LAMP.

(Sold by J. Lancaster and Son, Limited, Colmore Row, Birmingham.)

The new model of the Rubralux lamp has been brought out with the light filters arranged in sectors on a disc so that any one can be brought in position by turning the disc through one-quarter of its circumference. The disc provides yellow and two depths of ruby light, the fourth sector being clear glass for printing purposes. The lamp should be popular for amateur work, and it is sold at the same price as its predecessor—namely, 6s. and 9s. for oil and 10s. 6d. for gas.

THE ALTRINCHAM ROLLER-BLIND SHUTTER.

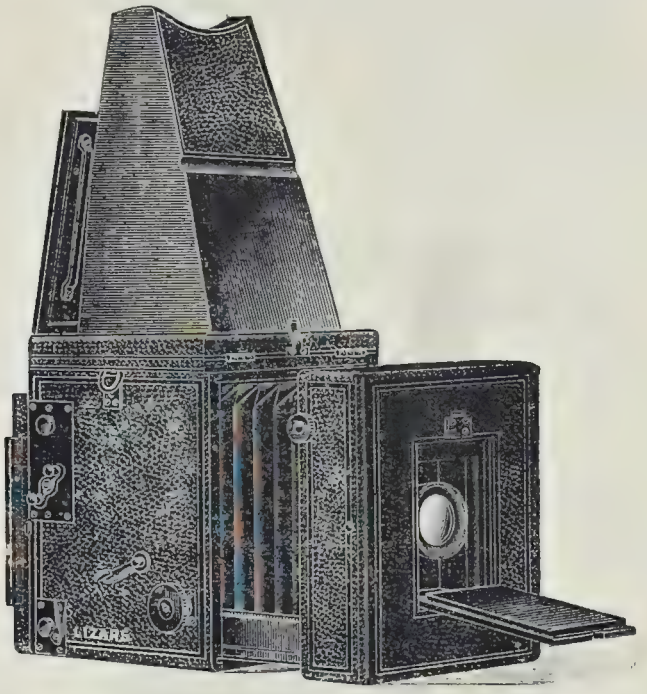
(Sold by the Altrincham Rubber Company, Mossburn Buildings, Altrincham.)

The new model of the roller-blind shutter has been made with the same dimensions as its predecessor, but with the highest speed increased by about 50 per cent.—that is to say, the 1-100th of a second being obtainable instead of 1-70th, and the 1-140th instead of 1-90th, these speeds applying to the larger and smaller sizes. The price of the new model is 5s. more than that of the respective size in the previous series.

THE CHALLENGE DE LUXE REFLEX CAMERA.

(Made by J. Lizars, 101 and 107, Buchanan Street, Glasgow.)

The present camera is a more elaborate form of the "Challenge" reflex camera reviewed in last year's ALMANAC. In it the makers have embodied a number of features which are recognised as indispensable for a camera of this class. In the first place, it is of long extension, giving a length of ten inches from lens panel to plate.



The lever which sets the mirror is close against the focussing screw, a point of great practical advantage. There is a rack and pinion, rising front, and the lens is shielded by a hinged panel in the camera front. The camera has a revolving back, with automatic catches for securing the plate in the upright and landscape positions. The

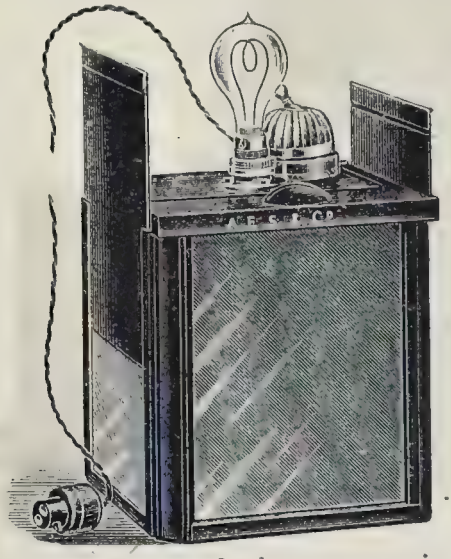
focal-plane shutter, which is fitted with a quick wind, is set with a half turn of the setting handle, and is arranged to give instantaneous exposures, from 1-10 to 1-1000 of a second, in addition to opening the full size of the plate for time exposures. These adjustments of speed are made by a mechanism outside the camera. The tall hood, 7½ inches, is a feature of the camera, and the ground glass focussing screen is instantly removable for cleaning, giving admission to the inside of the camera, so that the mirror, which is used silver side towards the lens, may be dusted at the expenditure of only a few seconds' time.

The camera is lightly made, although at its full extension the lens front is remarkably rigid. The price of the instrument, in quarter-plate size, with Ross "Homocentric" lens, *f*/6.3, is £15 10s. Other lenses may be supplied at the following prices for the whole outfit:—Cooke, *f*/6.5, £16; Zeiss "Tessar," *f*/6.3, £16 15s.; Ross "Homocentric," *f*/5.6, £17; Zeiss "Unar," *f*/5, £17; Goerz Double Anastigmat, *f*/6.8, £17 5s. These prices include three double dark slides. The camera is made also in the 5 by 4 and half-plate sizes.

THE "GEKA" DARK ROOM LAMP.

(Sold by A. E. Staley and Co., 19, Thavies Inn, Holborn Circus, London, E.C.)

A new addition to the series of dark room lamps, sold by Messrs. Staley, is the above, which is fitted with the "Geka" silk filters, having the advantage over other forms of light filters that they can be made with any desired absorption (thus ensuring safety when using orthochromatic plates), and are not liable to distortion by heat.



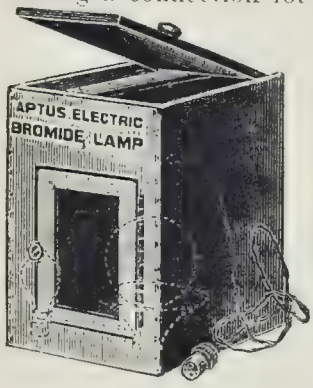
The lamp is fitted with a ground glass screen, in front of which the silk filter is placed, the grooves permitting of the removal of the filter and its replacement by another in a few moments. Three sides of the lamp are thus fitted with ruby, deep ruby, and yellow

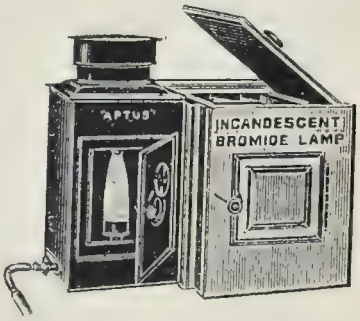
filters, two sides being provided with shutters. The whole arrangement of light traps is very good, and the lamp should be a useful one for all classes of work where electric current is available. The price is 42s., with incandescent lamp and seven feet of flexible connection with push for attachment to any domestic supply.

THE APTUS BROMIDE PRINTING LAMPS.

(Made by Sharp and Hitchmough, 101 and 103, Dale Street Liverpool.)

Two types of lamp are introduced by Messrs. Sharp and Hitchmough, the one for electric light and the other for incandescent gas. In the former, shown on the left of the drawing, the printing frame is made in the top of the chamber, pressure of the lid upon the paper forming a connection for the lamp. In the case of the incandescent



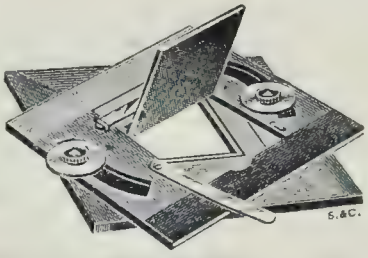


gas lamp, the same arrangement is adopted, but in this case the exposure is made by pulling out the shutter which separates the lantern from the right-hand portion of the apparatus. In each case negatives up to whole-plate can be printed in the lamps. The price of each is 35s., including one carrier of half-plate size.

THE NOMASK POSTCARD PRINTING FRAME.

(Made by Sanders and Crowhurst, 71, Shaftesbury Avenue, London, W.C.)

A frame of postcard size, permitting of any portion of the negative being selected for the postcard, has been introduced by Messrs.



Sanders and Crowhurst, in the shape of two square frames shown in the drawing. Negatives up to whole-plate can be accommodated, and the adjustments of the frames permit of any correction of the negative in the event of the camera not having been perfectly level at the time of exposure. Price 3s. 6d.

THE KODAK DEVELOPING TANK.

(Made by Kodak, Ltd., Clerkenwell Road, London, E.C.)

The new-style series of developing tanks, which was introduced by the Kodak Company last year, has been added to by the introduction of a larger size capable of taking spools up to 7 inches. Hitherto spools over 5 inches have had to be machine developed, in the well-known Model H apparatus, but the new tank now renders the later system as applicable to all the commercial sizes of spools as its predecessor. The new tank, it may be added, is an improvement on the earlier smaller sizes, in that it is necessary only to invert it two or three times during the twenty minutes' development, not to remove the film and the enclosing apron from it. This is done by the aid of the watertight lid shown in the figure. The price of the new tank outfit is 32s. 6d.

THE "TOGO" PRINTING FRAME.

(Made by the Birmingham Photographic Company, Ltd., Criterion Works, Stetchford, near Birmingham.)

This frame is quite a novelty among apparatus of this class, and permits, while very light, of practically the whole of the print being examined. The back is hinged to the frame, so that there is no liability to shift the paper when examining the printing. Pressure is applied by a spring sliding along the frame and guided by a groove in the side. Some idea of the compactness of the frame may be obtained from the fact that in the quarter-plate size its dimensions are half an inch thick and 4½ by 5½ inches. The frame in mahogany costs 6d., and is made also in leather board, price 3d. each, quarter-plate size. The mahogany frames are also made in sizes 5 by 4 (8d.), postcard (8d.), and half-plate 1s.

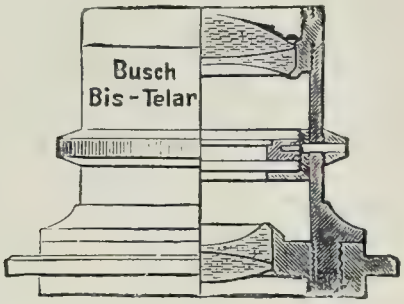
THE "BIS-TELAR" LENS.

(Sold by the Emil Busch Optical Co., 35, Charles Street Hatton Garden, London, E.C.)

The "Bis-Telar" differs from the majority of telephoto lenses, in that it is supplied in three sizes, each of a fixed focus. These lenses, however, embody the telephoto principle, inasmuch as the actual equivalent focus of the lens is about double the necessary camera extension. The advantage of this fact will be clear when it is understood that the possessor of any ordinary single-extension hand camera may employ the lens without any alteration to his apparatus, and thus obtain images of double the size, a facility which he could only obtain with ordinary (non-telephoto) lenses, by employing a camera of double the extension, and, of course, a lens of double the focal length. The lens is quite small in size, small enough to be accommodated by any of the ordinary patterns of folding, film, or plate cameras.

The No. 2 size, for example, fits in a flange, the threaded aperture of which is 1½ inches in diameter, the whole flange having a diameter of 2¼ inches. The lens is supplied to work at a rapidity of *f*/9, being supplied with an iris diaphragm, working down to *f*/45. The definition at the larger aperture is good, and the covering power at the smaller ample for the size of the plate for which the lens is sold. The facility which the lens gives for long focus work will

probably be valued all the more by the average amateur, for the reason that the construction of the instrument does not embarrass him in any way with telephoto calculations. The "Bis-Telar" is

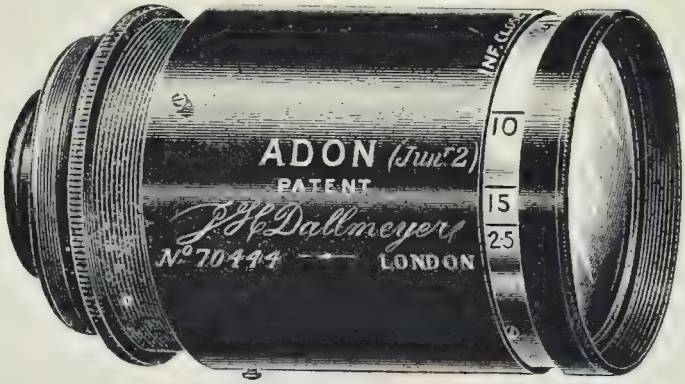


supplied in three sizes: No. 1 giving an equivalent focus of 7 inches, No. 2 of 10 inches, and No. 3 of 14 inches. These lenses are recommended for plates $3\frac{1}{4}$ by $2\frac{1}{4}$, quarter-plate, and half-plate respectively, and cost, in ordinary brass mount, 33s., 36s., and 48s. They are also supplied, with iris diaphragm and "Unicum" shutter, at 58s., 61s., and 85s.; or the cells only may be obtained to fit existing "Unicum" shutters at the price of 33s., 36s., and 48s. Nos. 2 and 3 are also obtainable, in focussing mounts, at 51s. and 63s.

THE JUNIOR "ADON" (No. 2) TELEPHOTO LENS.

(Sold by J. H. Dallmeyer Ltd., 25, Newman Street, London, W.)

The latest model of the "Adon" is provided with a new form of mount, which obviates any difficulties in the use of the attachment. It also provides for the instrument being adapted by the dealer, or even by the purchaser himself, to any variations which may be met with in the positive lens to which the "Adon" is fixed.



The instrument is intended for use with rectilinear lenses of the type fitted to the No. 3 Folding Pocket Kodak, the front component being removed and the "Adon" screwed in its place. By this substitution the user of the camera is provided with a lens of practically double the focal length, the focussing being done by means of the "Adon" itself, the large front piece of which moves

out from the tube. Although no enlargement of aperture is made in the camera lens, the condensing power of the "Adon" front lens enables exposures to be made with scarcely any increase upon those which would be given with the complete camera lens, and the user may thus give his ordinary snapshot exposures while obtaining the benefit of a long focus objective. The size of the Junior "Adon" has been reduced to a tube of only 2 inches length and 1½ inches diameter, and the attachment is sold in a leather case for £2 10s.

THE SOHO COMBINATION STUDIO CAMERA AND STAND.

(Sold by Marion and Co., 22-23, Soho Square, London, W.)

In offering this camera to professional photographers the makers have had before them, not so much originality of design, as thorough workmanship, from first to last. It has been their aim—and one which an inspection of the camera permits us to believe has been achieved—to produce an instrument which should not only present a handsome appearance in the studio, but should prove reliable in working for years after its purchase. To this end all working parts, whether visible or otherwise, have been studied equally as regards material and workmanship with those lying on the surface.

The support of the camera is a very strong pillar arrangement, strengthened by substantial side pieces. The elevating mechanism consists of square threads working in gun-metal nuts, and is of a very substantial construction, the camera itself being screwed to the table top, forming one solid piece. There are front and rack movements, which work very smoothly, the back spindle having a screw for instantly fixing the back at any point. The total bellows length is 48 inches, in the twelve inch size, and 54 in the fifteen inch. The camera is provided with a full-size back, with roller shutter, as well as with repeating back carrying the focussing screen in the same groove as the dark slide, the screen not needing to be removed when the slide is inserted, but merely sliding to the end of its groove. The camera is provided with a full size plate-holder, fitted with carriers down to whole-plate. The entire outfit is substantial in the extreme, and costs, in the 12-inch square size, £28 10s.; in the 15-inch size. £31 10s. There are clamps on back and front, taking a rod by means of which the focussing screen and the lens may be permanently screened.

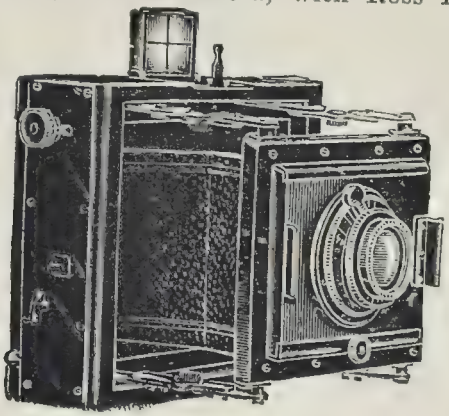
THE "ELITE" FOCAL PLANE CAMERA.

(Sold by the City Sale and Exchange, 90 to 94, Fleet Street, London, E.C.)

The camera pulls out to the infinity focus on the struts shown in the drawing, which are adjustable to the extent of about ½in. for variations in the length of focus of the lens. The front has rotating lens board whereby the up-and-down movement of the lens can be utilised either way of the plate.

The shutter has a very simple movement for altering the width of the slit, a lever on the left of the camera being raised and the winding key then serving to increase or diminish the width of the slit. The slit can open the full width of the plate, but not wider,

and there are automatic stop arrangements for preventing over-winding. The price of the camera, with Ross Homocentric lens,

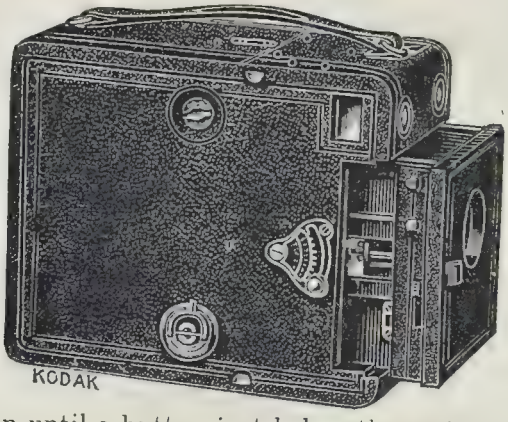


working at *f*/6.3, is £8 8s. in the quarter-plate size, the only one in which the "Elite" is at present made. The above figure includes three double dark-slides.

THE QUICK FOCUS KODAK.

(Sold by Kodak, Ltd., 57-61, Clerkenwell Road, London, E.C.)

Quite a novel feature in hand cameras is embodied in a new instrument brought out by the Kodak Company, under the above descriptive title. The camera is a Kodak of the box pattern, and the novel movement lies in the focussing arrangement. A notched scale is provided on the side of the camera, and by means of it the instrument is made ready for focussing on an object at any distance between 6 and 100 feet. The lens, however, is not moved into the



selected position until a button just below the scale is pressed, when the front of the camera flies forward and is held in the position. The exposure made, the front is pushed back flush with the camera body, and is so carried, with all its working parts enclosed, until a second subject presents itself, when it is again drawn forward to the same extension or to any other which at any moment before exposure

may have been selected. There is an indescribable snap and smartness about the movement which should enhance its selling powers quite apart from the actual assistance which the device affords in accurately setting the camera to scale. The way in which the movement is worked out recommends itself to the purchaser, and the dealer's task in demonstrating the points of the camera is assuredly a light one The Quick Focus Kodak takes a $5\frac{1}{2}$ by $3\frac{1}{2}$ (postcard) picture, and possesses all the usual accessories in the way of finders, stops, time, and instantaneous shutters. The price of the camera is 50s.

THE UNDER-CURRENT WASHER.

(Sold by W. Tylar, 41, High Street, Aston, Birmingham.)

The washer consists of a circular rack, provided with an upright stem, which admits the water to the lower part of any bucket in which the rack is placed, the whole arrangement thus serving the purpose of an efficient washer. The rack, when removed, allows of the plates being drained or dried *in situ*.



It is made in three sizes, quarter-plate, 5 by 4, and half-plate, at the prices of 2s. 6d., 3s. 6d., and 4s. 6d. respectively. Each washer contains twelve grooves, accommodating twenty-four plates if placed in pairs, back to back A postcard size of the washer is to be supplied.

BAUSCH AND LOMB SETS OF WIDE-ANGLE LENSES.

(Sold by E. Staley and Co., 19, Thavies Inn, Holborn Circus, London, E.C.)

These lenses are sold in their cells, so that they can be screwed into the mounts of the 5 x 4 Auto or Unicum shutters, and are

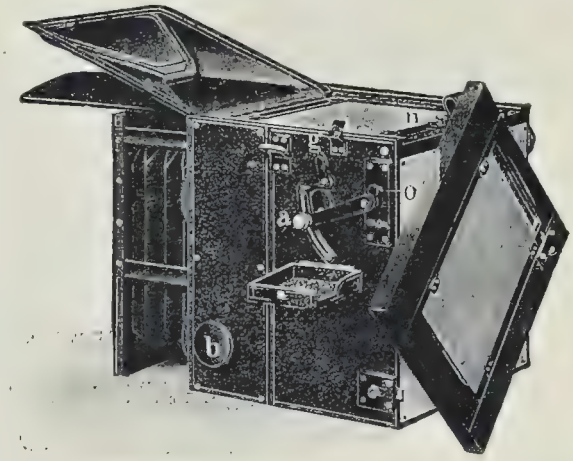


suitable for any of the quarter-plate, 5 by 4, or 7 by 5 cameras on which these 5 by 4 shutters may be used. The prices of the lenses are: 17s. 6d. for quarter-plate size (three inch focus); 5 by 4 22s. 6d. ($3\frac{2}{3}$ focus); and 7 by 5 ($3\frac{5}{8}$ focus), 25s.

THE "VOIGTLANDER" REFLEX CAMERA.

(Sold by Voigtlander and Son, 12, Charterhouse Street, London, E.C.)

The extending front of this reflex camera moves out on four rack-and-pinion struts, and is very rigidly supported at full extension, the distance from lens panel to plate in this position being



$10\frac{1}{2}$in. The camera has the now indispensable reversing back, carries focal plane shutter with outside adjustments of speed, and has the mirror easily accessible for dusting. The mirror is operated by levers on either side of the camera, that on the left depressing it, for focussing, and that on the right raising it.



" Energy ! "

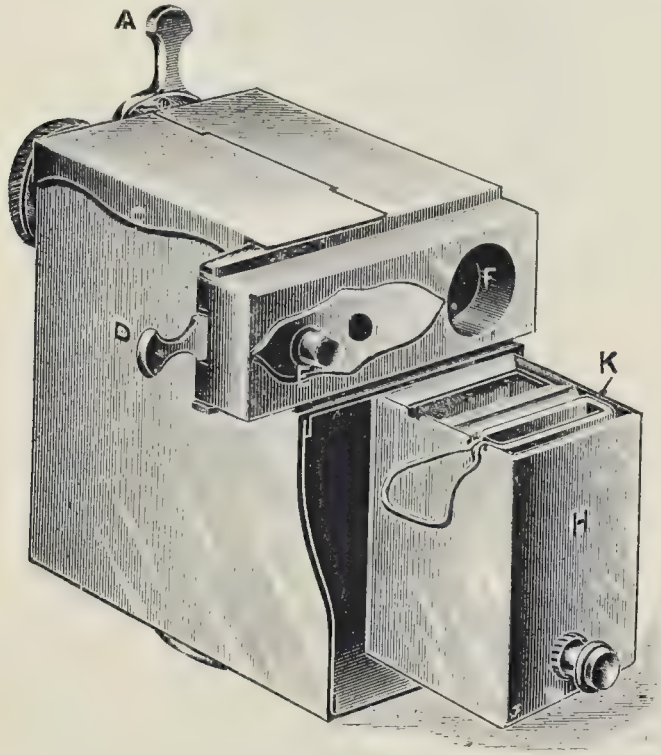
Specimen of
3-COLOUR BLOCKS
by Hood & Co., Limited, St. Bride Works, Middlesbrough

The shutter having been wound, pressure on the right releases both mirror and shutter. The price of the camera, with "Heliar" lens in quarter-plate size, working at *f*/4.5, and with three double dark-slides of solid form, is £19 10s.; with book-form slides, £20. A special telephoto attachment, giving a fixed magnification of two and a half times, is obtainable, price £3.

THE NEW TAQUTA FERROTYPE CAMERA.

(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

In the new model of the "Taquta" there are a number of improvements which justify mention of it, following on the description in last year's ALMANAC. The camera is now built so that the fixing and developing tank is accommodated in a chamber below the camera, being here more readily held than formerly, and giving the whole instrument greater solidity. The focussing arrangements have been improved by the provision of an aluminium focussing

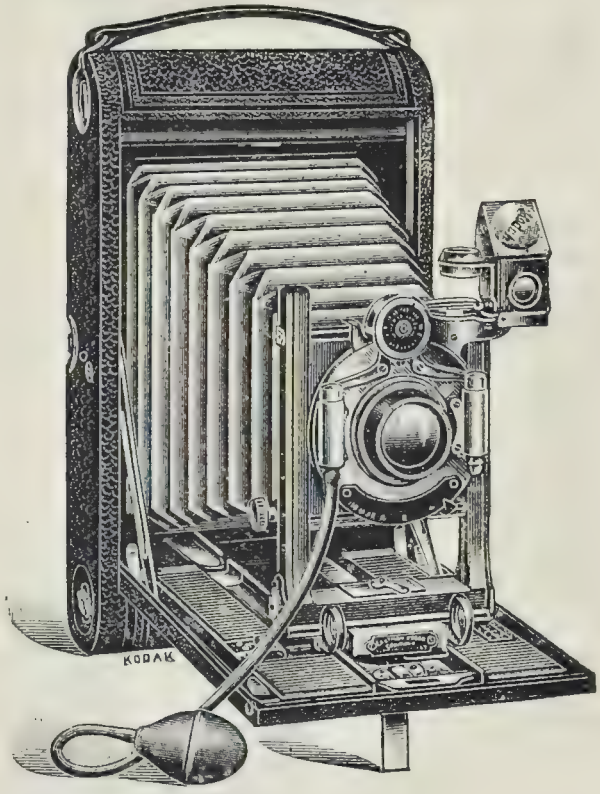


mount to the lens, and the changing mechanism has now the advantage that a separate movement is provided to transfer the exposed disc to the developing tank. As before, the "Taquta" takes about thirty ferrotype discs, and, as we pointed out last year, is capable of being very profitably employed at bazaars and similar functions. The price remains at 25s.

THE NO. 4 A FOLDING KODAK.

(Sold by Kodak, Ltd., 57-61, Clerkenwell Road, London, E.C.)

The No. 4 A completes the series of folding Kodak cameras, from the smallest to the largest, for half-plate marks the limit beyond which the practically useful hand camera may not go. Considerations of depth, when the focal length of the lens is over 8in. or 9in., step in to arrest the development of the hand camera into the larger sizes, even were many users to be found favourably disposd towards such necessarily larger and heavier cameras. In the No. 4 A bulk and weight are such as to withhold the title "pocket camera," yet it is carried very easily by its sling handle, much more so, in fact, than many box cameras taking a picture one-half the size. In form and



fittings it is modelled almost exactly on the No. 3 F.P.K., although it embodies one or two of the latter improvements which the Kodak Company have made in their cameras. For example, the rising front has a rack and pinion movement for focussing. In addition to the usual scale, there is the automatic device by which the front may be extended instantly to one of seven positions, representing sharp forms of objects at 8, 10, 15, 20, 25, 50, or 100 feet. The metal parts are aluminium, the covering is fine seal grain leather, and, as a whole and in detail, the instrument is handsomely and strongly made. Its price is £7 7s

EYE-PIECES FOR REFLEX CAMERAS.

(Sold by Marion and Co., 22 and 23, Soho Square, London, W.)

The useful accessory shown in the illustration is supplied by Messrs. Marion for any reflex camera.



The side-clips permit of the pair of eye-pieces fitting into any hood. The accessory (10s.) may be used with the Soho reflex camera, noticed in the ALMANAC for 1906, and now produced by Messrs. Marion with several improvements, chief among which is a taller hood, adapted for the most long-sighted persons.

THE "GRAFLEX" AND "PREMO" REFLECTING CAMERAS.

(Sold by Kodak, Ltd., 57-61, Clerkenwell Road, London, E.C.)

The "Graflex" possesses certain features which mark it out among reflex cameras, chief among which is a special accessory mirror in the hood by which the image on the ground glass can be examined when the camera is held at the eye level. The two figures 1 and 2 show the

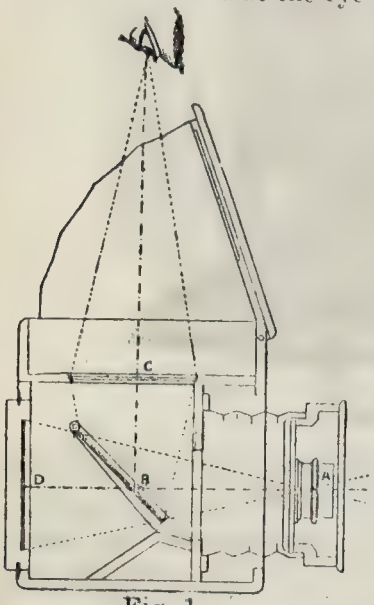


Fig. 1.

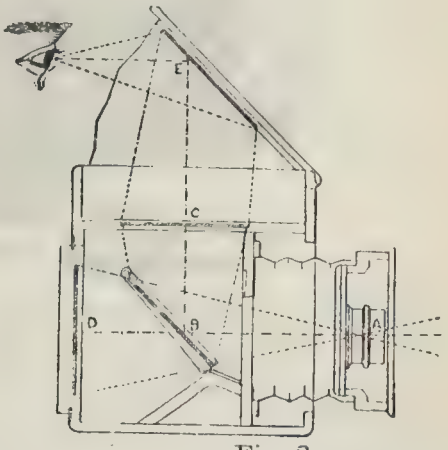


Fig. 2.

two methods of holding, and emphasise the obvious advantage of the instrument in permitting the taking of a higher point of view, often a matter of very great importance when photographing at public events.

The shutter of the "Graflex" is of the focal-plane type, and of the multiple slit variety, containing five slits of different widths in the complete blind. This arrangement we have known to be very convenient in practice, and in the "Graflex" the alteration from slit to slit is very conveniently made. In other respects the instrument is one of the highest class, which is not to say that it is overloaded with movements or finished with unnecessary cabinet making. In our estimation it is produced with a very careful eye to its practical performance, and for that, among other reasons, may anticipate receiving the notice of all who contemplate adopting the reflector

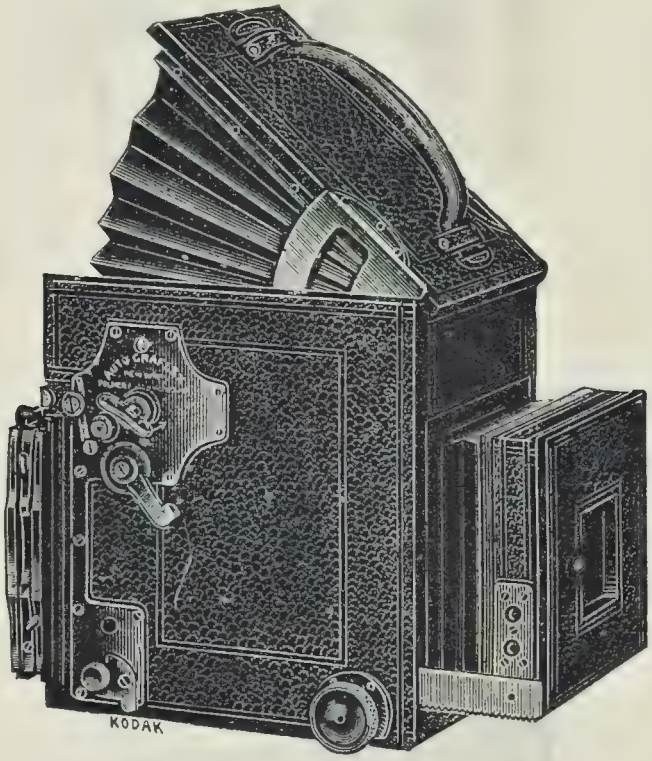


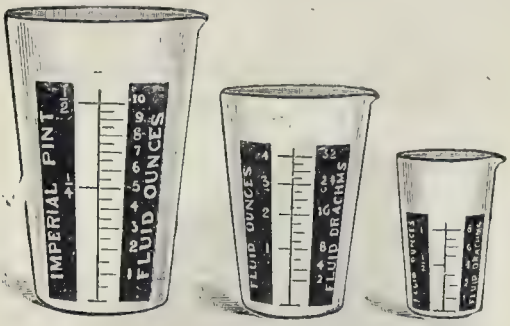
Fig. 3.—The "Graflex" fully opened.

principle in hand camera work. It is made in two sizes, quarter-plate and 5 by 4, the former costing, without lens, £15 12s. 6d., and the latter £17 14s. These prices, it may be judged, do not apply to an instrument which has not received, both in its initial stages and in its regular construction for the market, all the care and attention to details which a camera of this class demands from its maker. That such is the case with the "Graflex" is evident from the ease and smoothness of the working parts, and the freedom of the mirror and shutter from jar and abnormal noise when in operation. A critical inspection of the camera justifies the opinion that it is a highly efficient instrument of its class.

BLACK LINE MEASURES.

(Sold by W. Butcher and Sons, Camera House, Farringdon Avenue, E.C.)

The above is a very handy form of graduate, in which the lettering is clear glass on a dark ground, and thus very easily

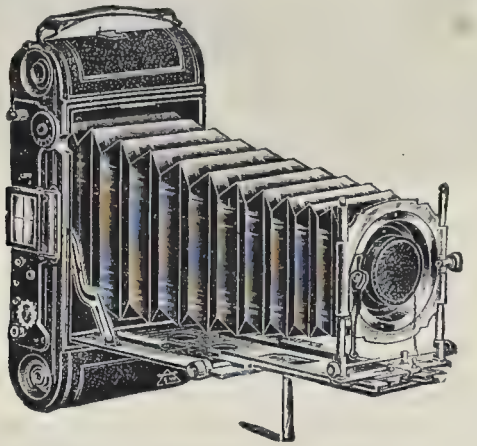


seen in a dark room. The set of these measures (1, 4, and 10 ounces) is sent out, securely packed in cardboard case, at 2s., and the separate measures are obtainable for 5d., 7d., and 11d.

THE "DEFT" FOLDING FOCAL PLANE CAMERA.

(Sold by W. Watson and Sons, 313, High Holborn, London, W.C.)

The above is a double-extension folding camera, provided with all the usual movements, including large rise of front, and fitted with the "Holostigmat," Series I., of 4½ inches focus. The lens

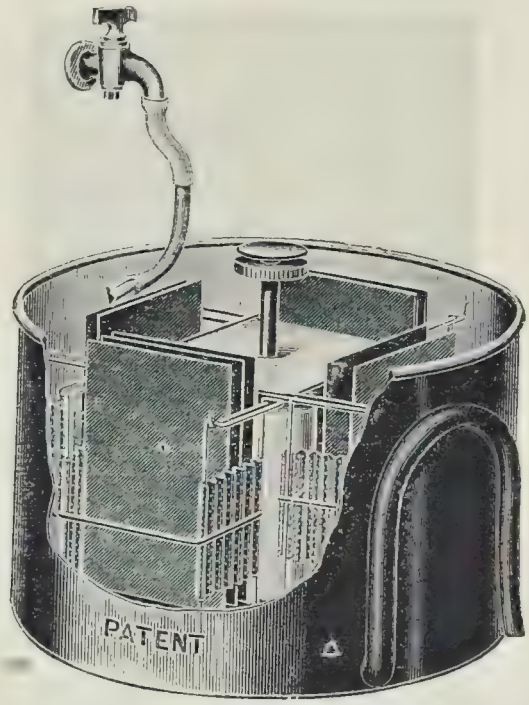


is recessed in a metal panel of special construction. The extension of the camera is such that the separate components, 7¼ and 8½ inches in focal length, can be used. The camera may be used for both roll films and plates, and costs £13 10s

THE "CIRCU" WASHER.

(Made by David Allan and Co., Whitfield Works, Mansfield Street, Shoreditch.)

In this instrument four racks are attached to a square plate, which is pivotted upon an upright stem, affixed to the base of the washer. The water inlet on the inside of the washer causes the rotation of the whole construction upon the pivot.



The negatives are thus very thoroughly exposed to the water, and the washer, so far as we are able to judge, should effectually rid the negatives of hypo. The prices are as follows:—Quarter-plate, 7s. 6d.; half-plate, 10s. 6d.; 5 by 4, 8s. 6d.

THE LANTERN SLIDE HEATING CASE.

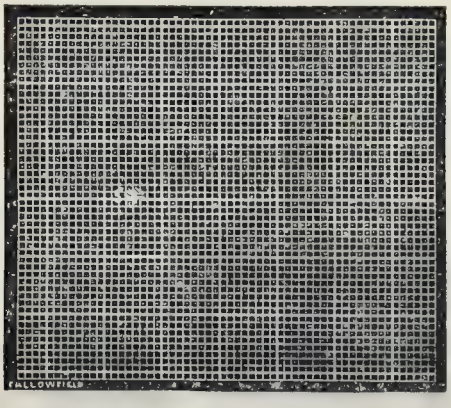
(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

The apparatus consists of a baize-lined case, the front of which pulls down to permit of the introduction of two horizontal piles of slides. Between these latter is a copper tank, which is filled with boiling water at the time the case receives its contents of lantern slides, and thus serves to keep them warm until arrival in the exhibition room. The case front is lined on the inside with rubber tubing, so that the slides are held firm. Th apparatus, which holds about ninety slides, should be a most useful accessory to the lanternist. Its price is 10s. 6d.

RULED FOCUSSING SCREENS.

(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

Messrs. Fallowfield have hit upon a useful idea for enlargers in providing these ruled screens, which are inserted in the holder in place of the negative, the film of one registering as regards position with the film of the other. The focussing can thus be done with

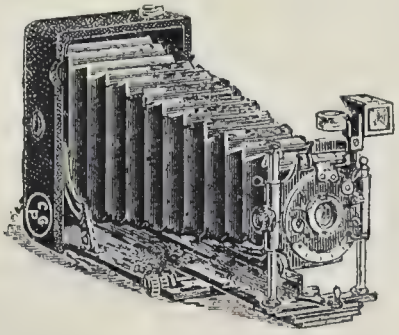


the greatest accuracy and the scale of enlargement adjusted by the ruled divisions of the screen. The latter may be selected according to the requirements of the user. The screens before us are ruled into squares of half an inch diameter and less, the side of each square being divided by eight lines, making a series of 64 smaller squares. The screens should be very useful to enlargers. They are made in any size, up to half-plate, at prices as follows:—Quarter-plate, 6d.; 5 by 4, 7½d.; half-plate, 9d.

THE "FREE-FILM" CAMERA.

(Sold by the City Sale and Exchange, 90 to 94, Fleet Street, London, E.C.)

In this model of a folding film camera the City Sale and Exchange can offer a little instrument which possesses a good many advan-



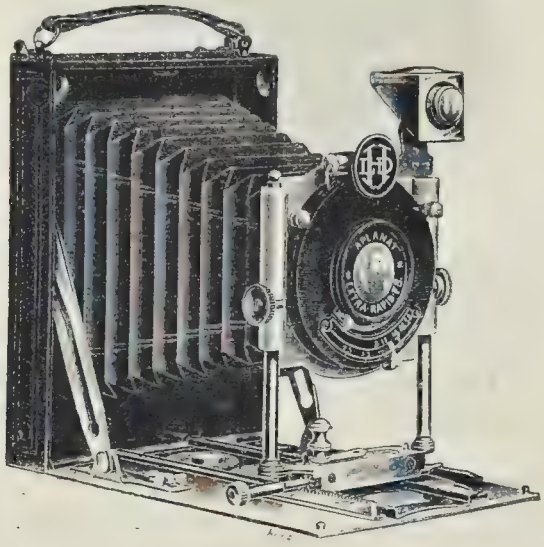
tages. In the first place, it has a long extension sufficient for the use of the single combination of the lens, rack and pinion rising front, and a cross movement worked by a winch screw.

It is fitted with a special infinity catch, thrown out of action instantly, and changed from plates to films by a simple movement. The camera is made for use with plates, and requires no extra adapter when employing them. The price, with extra-rapid Aplanat lens, working at *f*/8, and Bausch and Lomb "Unicum" shutter, is £3 12s. 6d.

THE "ARIEL" CAMERA.

(Sold by Houghton and Co., 88 and 89, High Holborn, London, W.C.)

The "Ariel" camera is a compact instrument, measuring in the quarter-plate size—it is not made larger—5½ by 4¼ inches, and having a thickness of 1¼ inches.



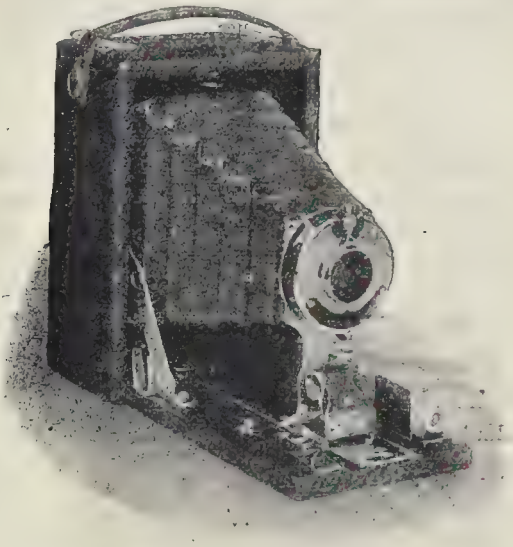
The camera, though thus very compactly made, affords considerable facilities. It has all the usual movements, including focussing scale, time, bulb, and instantaneous shutter, together with rising front and reversible finder; and its very compact form should recommend it as a tourist camera. The price of the "Ariel," with two single dark slides, is £3 3s.

THE "PREMOETTE."

(Sold by Kodak, Ltd., 57-61, Clerkenwell Road, London, E.C.)

Under this name Messrs. Kodak, Limited, have brought out an addition to the series of well-known Premo cameras, the notable feature of which is its small proportions and simple construction. The "Premoette" takes negatives 3¼in. by 2¼in., and is made to take the "Premo" film pack of this size, the whole apparatus, with the pack in position, being then self-contained and equal to producing

a dozen exposures. Thus the camera is in line with other Kodak instruments in being daylight loading and extremely portable. The new camera is fitted with a single lens shutter, with everset instan-



taneous, time, and bulb movements, and a series of four stops. It has finder for horizontal and vertical pictures and a focussing scale, which is sufficiently marked for the intensity of the lens.

THE SALEX POCKET CAMERA.

(Sold by the City Sale and Exchange, 99 to 94, Fleet Street, London, E.C.)

The above is a very compact camera measuring, when closed, 1½in. in thickness, and 5 by 3½. It accommodates plates 3½ by 2½, and is provided with a double extension, the total length between plate and diaphragm slot being 8¼in. The camera is scaled for the

complete lens and its single component, and costs, with "Panorthostigmat," £4 17s. 6d.; with extra-rapid Aplanat, working at *f*/8, its price is £3 7s. 6d.

These prices include three double dark-slides in folding purse.

THE "HOLOSTIGMAT," *f*/4.6.

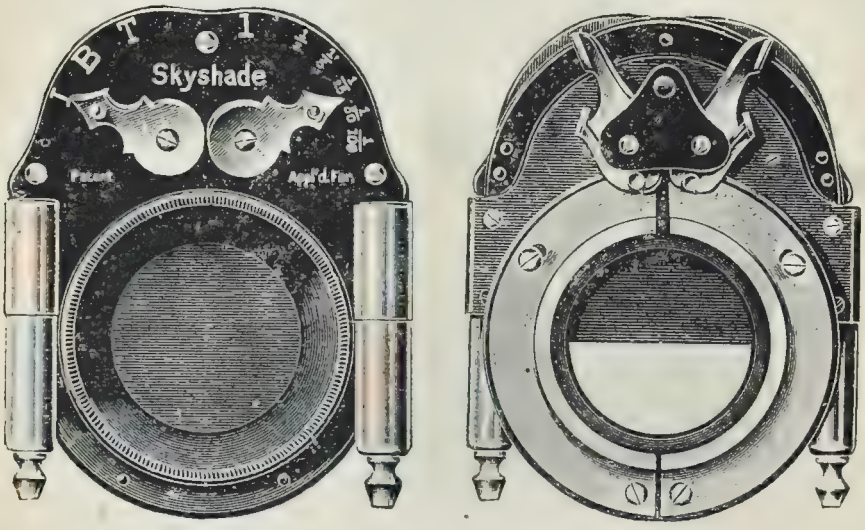
(Made by W. Watson and Sons, 313, High Holborn, London, W.C.)

An addition has been made to this series of anastigmat lenses in the shape of a "Holostigmat," working at the aperture of *f*/4.6. They have the advantage over other lenses of this large aperture, in that the separate combinations may be used by themselves, as long focus lenses of aperture *f*/8.5. The lens is made with the separate combinations of equal or of dissimilar focal length, the quarter-plate lens being obtainable as a $5\frac{5}{8}$ inch focus, with the separate combinations, each $8\frac{1}{2}$ inches focal length. The price of the lens in the first case is £8 12s. 6d.; in the second, £7 15s.; and similar facilities are offered by Messrs. Watson in the various sizes. The longest focus obtainable is $14\frac{3}{4}$ inches, suitable for a 12 by 10 plate, and costing £42. The lenses of the longer focal length are of the same large aperture as the smaller ones.

THE SKY-SHADE SHUTTER.

(Sold by the Emil Busch Optical Co., 35, Charles Street, Hatton Garden, London, E.C.)

Under this title a shutter is supplied, to be used only in front of the lens, in which position a considerably longer exposure is given to the foreground than to the sky. This effect is obtained by an up-and-down movement of the shutter plate. The shutter is an everset one, and adjusted to time, instantaneous, and bulb.



The instantaneous exposures range from one second to one hundredth, the alteration being very quickly made by movement of the pointer shown at the right of the drawing. The prices and sizes of the shutter are as follows:—

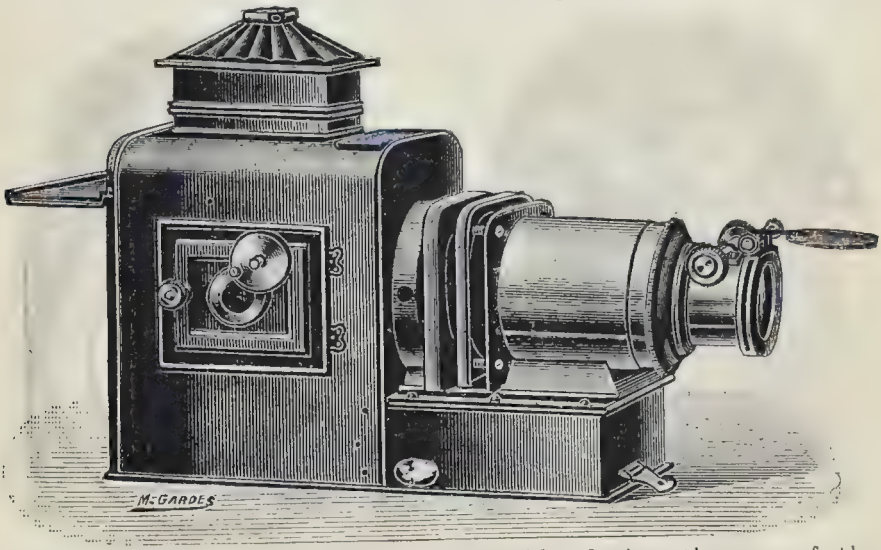
No.	Light Opening.	For Lenses with free diameter of	Will fit Barrels or Mounts with diameter of	PRICE.
1	1 $\frac{3}{16}$ in.	Up to 1 in.	1$\frac{1}{4}$ to 1 $\frac{9}{16}$ in.	45/-
2	1 $\frac{7}{16}$ in.	1$\frac{1}{8}$ to 1$\frac{3}{8}$ in.	1$\frac{5}{8}$ to 2 $\frac{1}{16}$ in.	62.6
3	2 $\frac{1}{16}$ in.	1$\frac{1}{2}$ to 1$\frac{7}{8}$ in.	2$\frac{1}{8}$ to 2$\frac{3}{4}$ in.	75/-

In each case the attachment to the barrel of the lens is very firmly and conveniently made by a spring band at the back of the shutter, controlled by the two levers shown in the upper part of the drawing. This clamp movement should be a remarkably efficient one, and in other respects the shutter, from its extreme lightness of working, ought to be found convenient by photographers having to make intermittent exposures, such as on occasions when moving figures have to be dodged, in night photography, for photomicrography, etc. The shutter is made in metal, and, in the No. 1 size supplied to us, it measures outside 2½ by 3 inches.

THE "EXCELSIOR," NO. 10, OPTICAL LANTERN.

(Sold by the City Sale and Exchange, 90 to 94, Fleet Street, London, E.C.)

Under this title the City Sale and Exchange offer a high-class optical lantern, having 4½inch condensers, open and divided stage, whereby the instrument may be used for scientific experiments, projected upon the screen. It has a 2½ inch objective, is fitted with tinting slot and flasher, and actuated by double pinion. There is a special ventilator on the body of the lantern, and the doors on each side are fitted with side-holes, and provided with vulcanite



knobs, which can be handled comfortably during the use of the lantern.

The whole front is solidly made in brass, and the price of the apparatus, complete with lime tray (but without jet or lime), is £3 12s. 6d.

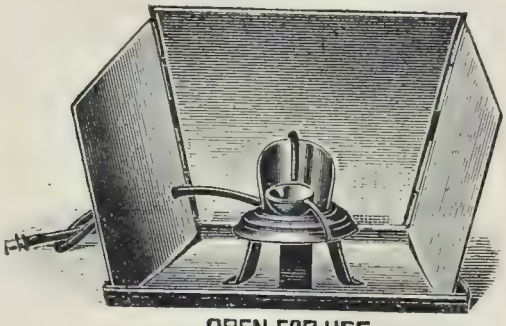
THE APTUS FLASH-LIGHT SHADE.

(Made by Sharp and Hitchmough 101 and 103, Dale Street, Liverpool.)

A portable holder for flash candles or a flash lamp is supplied at the price of 3s., and is almost sufficiently explained by the drawings.



CLOSED.



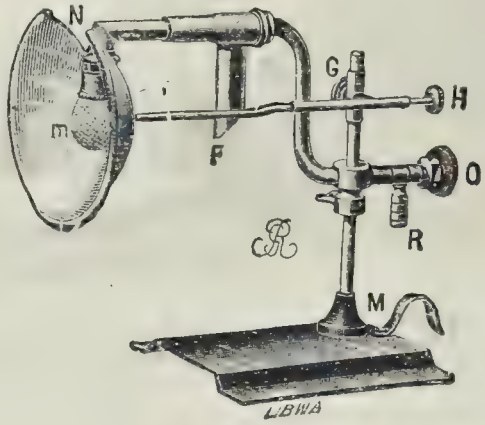
OPEN FOR USE

It is fitted at the back with a handle by which the operator can hold it whilst the enamelled interior acts as a valuable reflector. For accumulating much of the dust which arises from flash-light work, the shade should be extremely useful.

THE ALKO INCANDESCENT LIGHT.

(Sold by Romanet and Guilbert, 26, Red Lion Square, London, W.C.)

This lamp, which is specially introduced for enlarging use, is provided with an incandescent mantle of the inverted pattern, which



dispenses with the use of a perpendicular chimney, so that the lamp can be placed in a lantern like a lime jet. The inverted mantle is placed at the focus of a condenser (N in the drawing), and is perfectly self-contained, being fed with vaporised spirit from the reservoir R. The apparatus is made throughout of nickled copper and brass, the mounting being on a steel plate aluminium-bronzed,

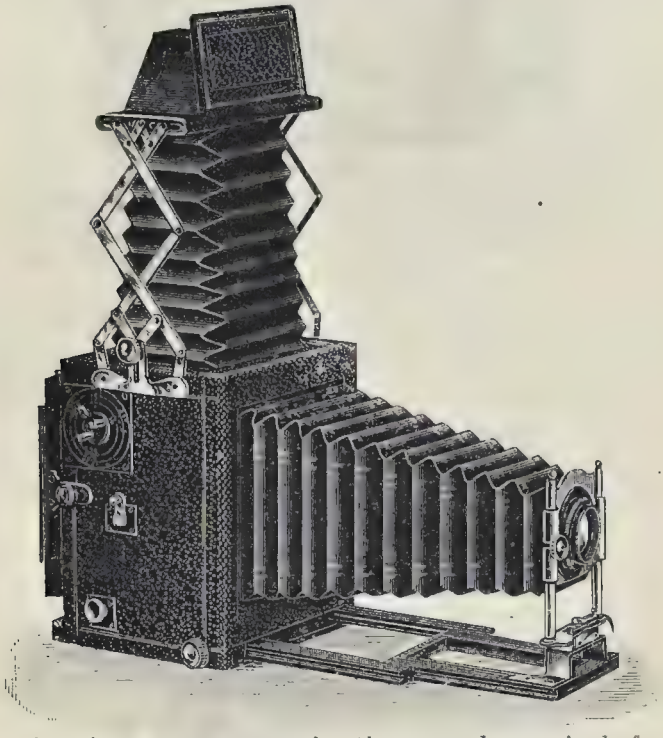
The combustion takes place from a metallic cartridge filter, highly permanent compared with a wick, and needing to be changed about once a year. The price of the complete apparatus, as shown in the figure, is 26s.; or without the reflector and its support, 21s.

The apparatus should be extremely useful to lanternists and enlargers.

THE FOLDING PLANOREFLEX CAMERA.

(Made by J. Lancaster and Son, Ltd., Colmore Road, Birmingham.)

Messrs. Lancaster have a new model of reflex camera, which, by its great portability and other convenient features, should be sure of a wide popularity. As will be seen from the figure, the camera closes up to the small dimensions of the body, and has a very convenient arrangement of hood, erecting itself on a description of lazy-tongs. This accessory permits of the hood being instantly put into action, and of being fixed at any position. The focal-plane shutter of the camera contains three slits: one, the full width of

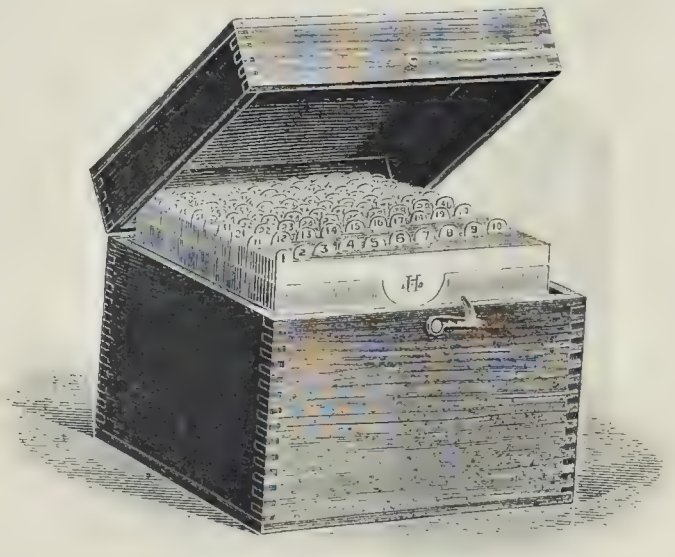


the plate for time exposure work; the second, one inch for medium rapidity; and the third, one-eighth of an inch for the highest speeds. The whole blind is wound by an extremely rapid movement, and the change from time to instantaneous is made in a moment. Speeds intermediate between those given by the three different widths of slit are obtained by altering the tension of the spring. The camera carries reversing back, rising front, and other movements familiar to those who know the present pattern of the Planoreflex. The price in quarter-plate size, without lens, is £7 7s.

NEGASYS FILES.

(Sold by Houghton and Co., 88 and 89, High Holborn, London, W.C.)

Among the developments of the card index system of filing which Messrs. Houghton have applied to the storage of negatives and prints, we have to notice a series of smaller boxes for filing negatives in numerical order

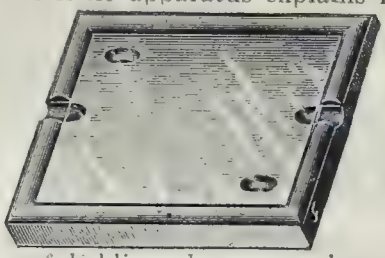


The illustration shows the arrangement, each card with its catch-head being in reality an envelope for a film negative. Roll-film, even of the non-curling variety, is kept quite flat in this form, and we know of no better system of storing negatives. Similar boxes are provided for glass negatives. The prices are as follows:—Boxes to take 50, with envelopes, quarter-plate size, 1s. 6d.; postcard or half-plate size, 2s. 6d.; whole-plate size, 3s. 9d. The film files are made in boxes of 100, costing 3s. in quarter-plate and 4s. 6d. in postcard size.

THE LANTERN SLIDE AND COVER GLASS CLEANING FRAME.

(Made by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

The drawing of this little apparatus explains its object, which is

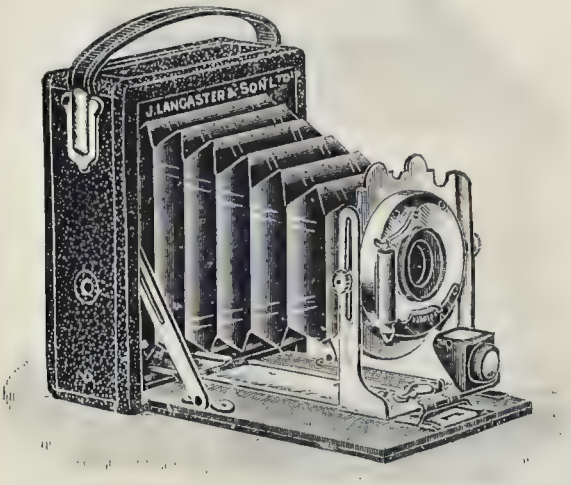


the very simple one of holding the cover glass or lantern slide in position whilst being polished. The price is 1s.

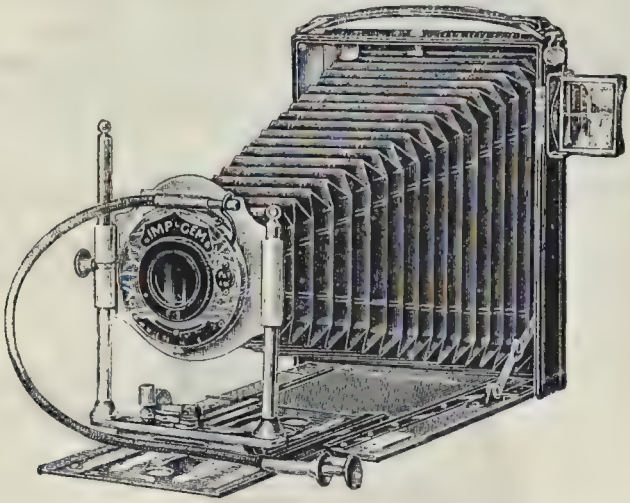
THE POCKET AND IMPERIAL GEM CAMERAS.

(Made by J. Lancaster and Son, Ltd., Colmore Row, Birmingham.)

Two types of pocket camera have been introduced by Messrs. Lancaster under the above names, and are very portable instruments, possessing also sufficient range of movements for the requirements of the average amateur photographer. The set includes



camera, lens, shutter, and double dark slide, rising and cross front, and double swinging front, with brilliant finder. The shutter is the Lancaster Self-Setting or the Bausch and Lomb, and the prices



of the apparatus are from £1 1s. and £2 2s., in the quarter and half-plate sizes, up to £1 11s. 6d. and £3 3s. The outside dimensions of the Pocket Gem are only $4\frac{7}{8}$ inches by $3\frac{7}{8}$ inches by $1\frac{1}{4}$ inches.

THE "ACTINOLUX" PRISM.

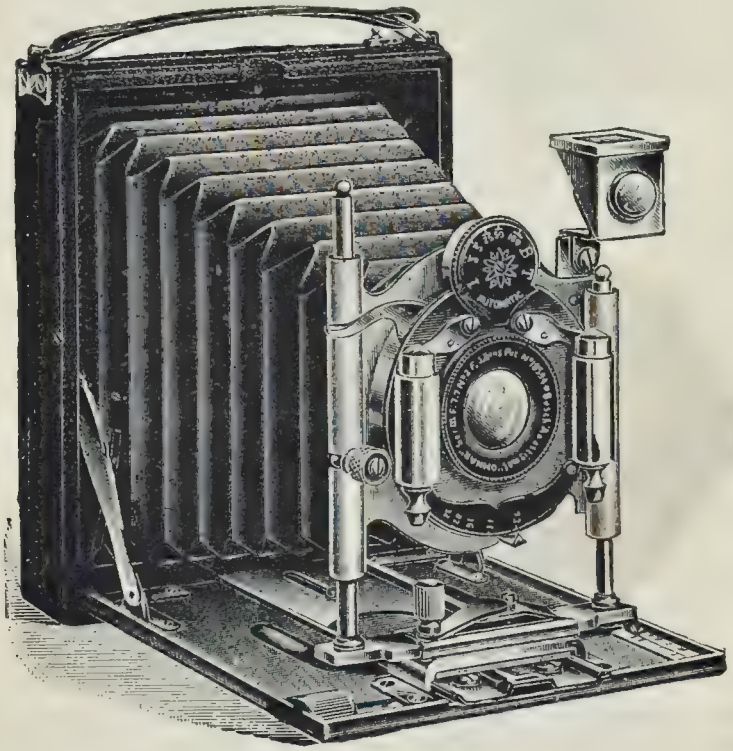
(Made by W. Watson and Sons, 313, High Holborn, London, W.C.)

For use with the lens sold also under the above name and recommended particularly for process work on account of its transparency to ultra-violet light, Messrs. Watson have introduced a prism of the same character, an addition which is certainly necessary for the process engraver, otherwise the advantage in point of speed which the "Actinolux" lens affords will be lost. We refer elsewhere ("Epitome of Progress") to the transparency of the "Actinolux" lens, and we have no doubt that the glass of the prism is of the same character. The prisms are sold in six sizes, from two inches to four inches square, at prices from £5 17s. 6d. to £19.

THE "CHIC" POCKET CAMERA.

(Sold by the Emil Busch Optical Co., 35, Charles Street, Hatton Garden, London, E.C.)

A complete quarter-plate camera, which measures, with the plate



ready for exposure, only 4½ by 5½ inches, and is only 1¼in. thick, should merit the approval of those who insist on reducing the bulk

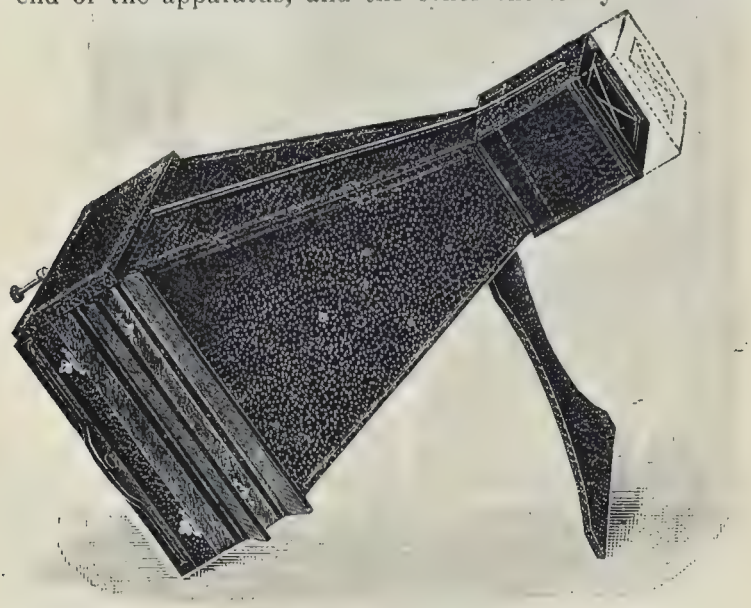
of their apparatus to a minimum. The "Chic" camera has not had its bulk reduced to these small dimensions at the sacrifice of its working efficiency. It extends to 6½ inches, being, therefore, suitable for a lens of 5 inches focus.

It has a rising front, reversible finder, instantaneous everset shutter, with time, bulb, and instantaneous exposures adjusted by the turning of a pointer to the scale of speeds of from 1-100 of a second to one second. The diaphragm scale of the lens is marked from *f*/8 to *f*/45, and the apparatus is strongly made and neatly covered in black leather. The dark slides are of the single variety, three, and a focussing screen being supplied with the camera. The price of the camera, fitted with the Busch rapid rectilinear, is £4; or with Busch "Omnar" anastigmat, working at *f*/7.7, £6 2s. 6d. The camera is fitted with two bushes and tripod screw for use on a stand.

THE DAORNYTA ENLARGING CAMERA.

(Made by J. Lancaster and Son, Ltd., Colmore Row, Birmingham.)

This ingenious enlarging apparatus serves for use with daylight or with any artificial light, such as the Parabaloid reflector of the same firm, and further has the great advantage that the various degrees of enlargement are obtained without any calculation. The dark slide carrying the paper is inserted in one of three slots at the wider end of the apparatus, and the other extremity of the camera



racked to or from the lens, according to the degree of enlargement required. The positions for the negative are adjusted on a scale shown in the figure, a rod connecting the latter with the negative chamber. The price of the apparatus for enlarging from quarter-plate is 12s. 6d.

THE LANTERN-SIZE REFLEX CAMERA.

(Made by Talbot and Eamer, 54, Seele Street, Liverpool.)

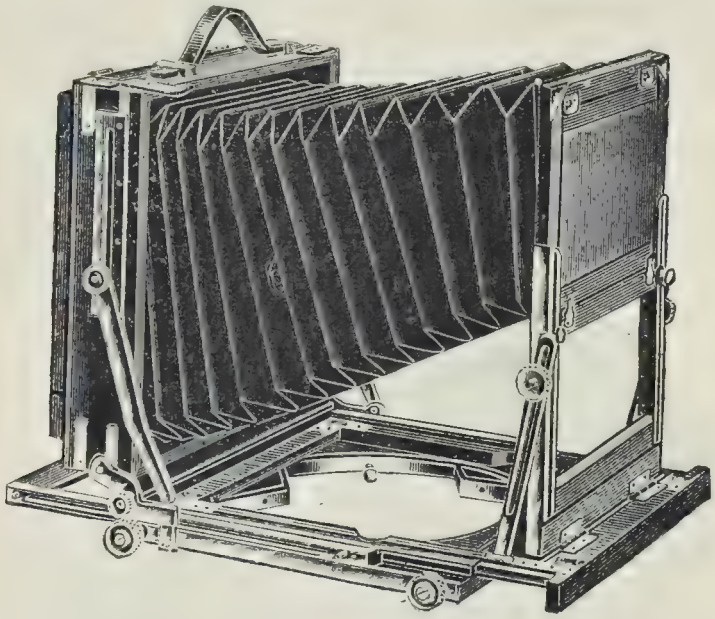
A reflex camera of the well-known Miral pattern, taking a picture 2½ by 2 inches, is a new introduction of Messrs. Talbot and Eamer, who are putting it upon the market, chiefly for the convenience of tourists, and recommending it, especially as a ladies' camera, the outside dimensions being only 4½ by 4 by 3 inches. The camera, which is exceedingly well made, is fitted with a Cooke focussing lens of four inches focus, and is provided with three double dark slides.

THE "SALEX" HALF-PLATE AND STEREO CAMERA.

(Sold by the City Sale and Exchange, 90 to 94, Fleet Street, London, E.C.)

A handsome stand camera is supplied by the City Sale and Exchange for all the ordinary purposes of a half-plate instrument, and, in addition, for stereoscopic work, the width of the lens panel (5¾in.) accommodating a pair of stereo lenses.

The camera has reversing back, triple extension, and a wide-angle movement of the back to the front. It has great rise of front—viz., 4¼in.—and when at full extension gives 19in. between



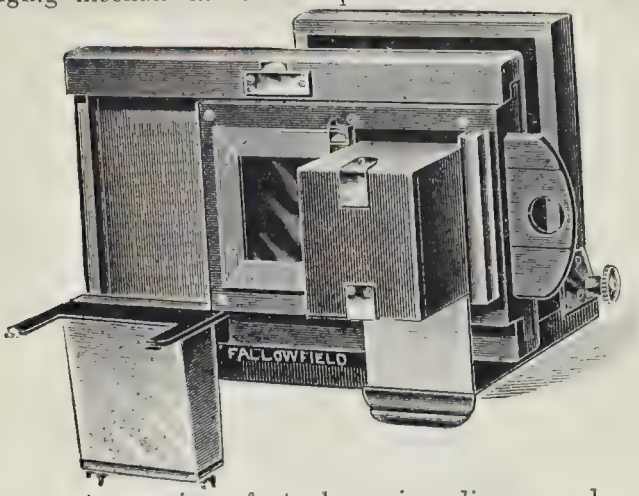
the diaphragm and the plate. With turntable baseboard and three double book-form slides, but without lens, the price of the camera is £4 2s. 6d.

THE AUTODEL FERROTYPE REPEATING BACK.

(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

The above is an accessory for any ordinary camera, whereby ferrotype negatives may be made and developed in full daylight. The back consists of a chamber, taking about thirty of the ferrotype plates, which measure 2½ by 2 inches each. Each plate is carried in a sheath, and immediately after exposure is transferred to a developing tank, and then is quickly passed on by the operator to the

fixer. The back provides for the focussing of each picture, and the changing mechanism for the plates is of such a simple kind

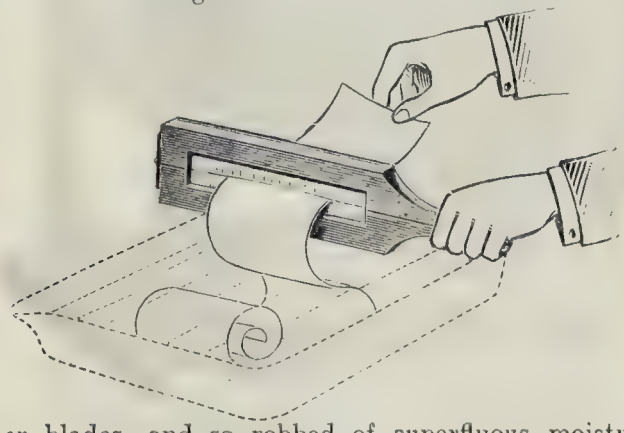


that we cannot conceive of its becoming disarranged. The price of the Autodel changer, complete with the developing accessories, is £3 10s.

THE "PRIMUS" FILM SQUEEGEE.

(Sold by W. Butcher and Sons, Camera House, Farringdon Avenue, E.C.)

The drawing clearly illustrates the construction and use of this little instrument. Lengths of roll film are drawn between the



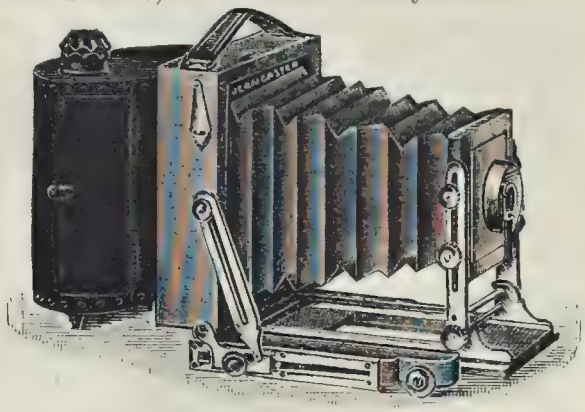
two rubber blades, and so robbed of superfluous moisture. The handle on which the rubbers are mounted is divided and hinged to facilitate the insertion of the end of the band of film. The price is 2s.

THE ELLIPSOID ENLARGING LAMP.

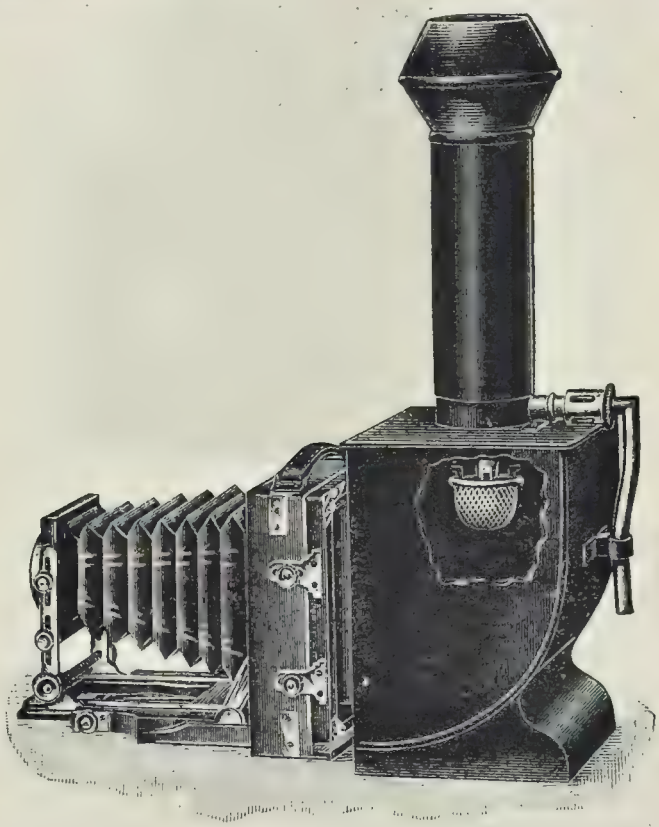
(Made by J. Lancaster and Son, Ltd., Colmore Row, Birmingham.)

This piece of apparatus consists of a polished reflector, which can be illuminated either by incandescent gas, magnesium ribbon, or acetylene burner. For use with gas, Messrs. Lancaster also make it in horizontal pattern, an inverted incandescent burner being affixed

in the upper part. The lamp gives a very even illumination, owing to its elliptical surface, and is made ready for attachment to any



of Messrs. Lancaster's cameras. It can be fitted to any other camera at a slightly increased price. For incandescent gas the prices are:

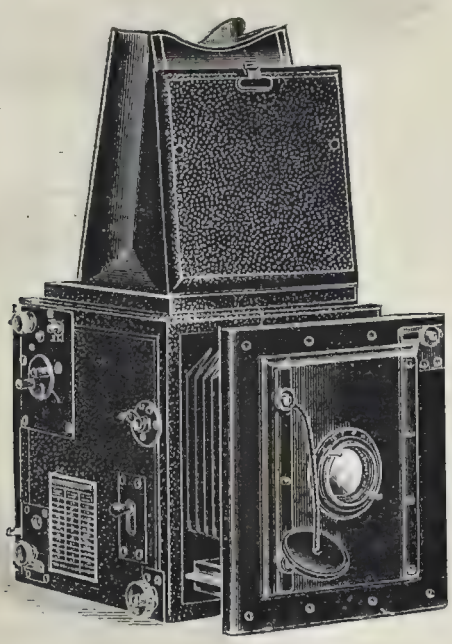


Quarter-plate, 6s. 6d.; 5 by 4, 8s.; half-plate, 9s.; and whole-plate, 13s. 6d.

THE PLANEX REFLEX CAMERA, NO. 2.

(Sold by the City Sale and Exchange, 90 to 94, Fleet Street, London, E.C.)

This reflex camera is offered as an instrument for all the most varied forms of photography, since it is built with a triple extension, giving a distance from lens to ground glass of no less than $21\frac{3}{4}$ inches in the half-plate size. The camera has a tall hood, and is fitted also with a hooded focussing screen for occasions when direct focussing is required. It has ample rising and cross-front movements, rotating reversing back, and a convenient arrangement of the focal-plane shutter, whereby the setting of the shutters to time automatically raises the mirror.



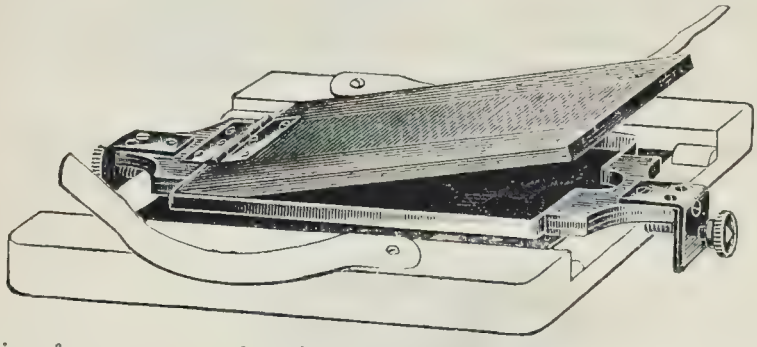
In other respects the camera has the movements of a high-class reflex instrument, its price in quarter-plate size, with three dark slides, being £7 7s.; in half-plate, £8 8s.; and in whole-plate, £10 10s. It is fitted with any leading lens at approximately list prices, the shortest focal lens which the half-plate instrument will take being $8\frac{3}{4}$ inches.

THE "PRIMUS" POSTCARD REGISTERING FRAME.

(Sold by W. Butcher and Sons, Camera House, Farringdon Avenue, E.C.)

In this very simple yet efficient accessory Messrs. Butcher have provided the means of taking postcards from a negative without loss of time in placing each card in position. The frame is fixed to any ordinary half-plate printing frame by the set screw at each end, and the cards are then dropped into the framework and

exposed without loss of time in adjustment. For gaslight printing, pressure of the hand on the spring back of the registering frame is sufficient. For printing-out papers the springs of the



printing frame are employed. In either case the back of the registering frame springs up on pressure being released. The frame is strongly made, and costs 4s. 6d.

A COMBINED MEASURE, BOTTLE, AND FUNNEL.

(Sold by W. Butcher and Sons, Camera House, Farringdon Avenue, E.C.)

An addition to the many useful dark-room accessories which have emanated from this firm has been made by Messrs. Butcher in the



shape of this piece of apparatus, the purpose and advantages of which are almost sufficiently explained in the drawing. The bottle effectually avoids the difficulty experienced by some of pouring small quantities of liquid from an ordinary bottle, and the double graduation of the bottle adds to its usefulness when compounding a developer by diluting a strong stock solution. The bottle is made in two sizes, 10 and 20 oz., at 1s. and 1s. 3d. respectively.

THE C. X. R. STEEL DISH.

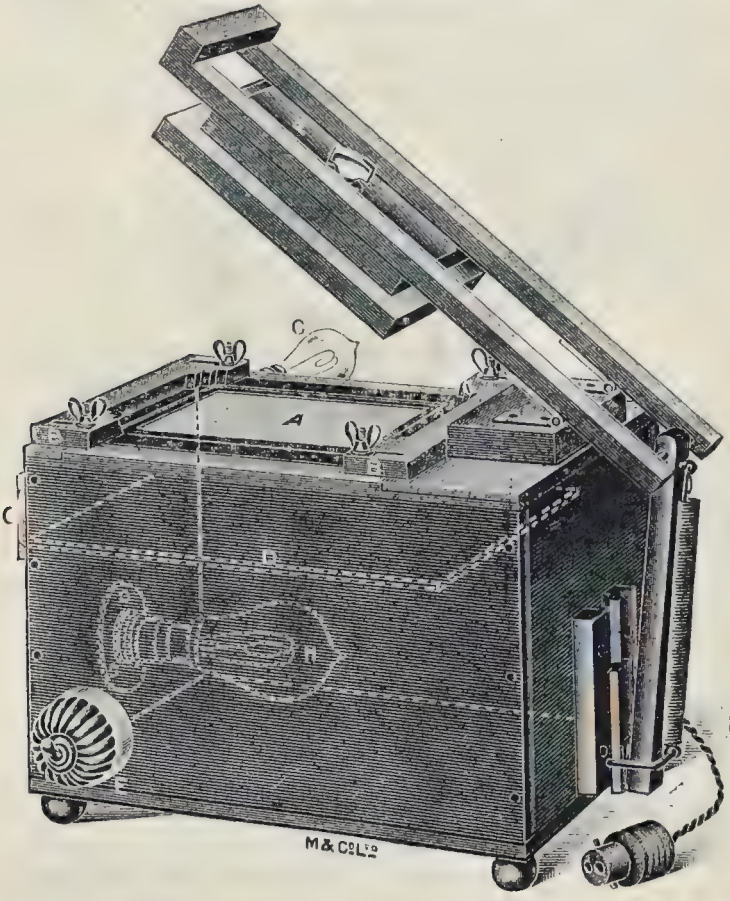
(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

Messrs. Fallowfield have introduced a new series of enamelled steel dishes, which, while being very light and strong, are capable of withstanding a good deal of wear and tear. The sample shown to us is well shaped and allows the plate to lie flatly in it. The dishes are sold at prices from 9d. in the quarter-plate size to 15s. 24 by 19.

THE "RENAUD" QUICK BROMIDE PRINTER.

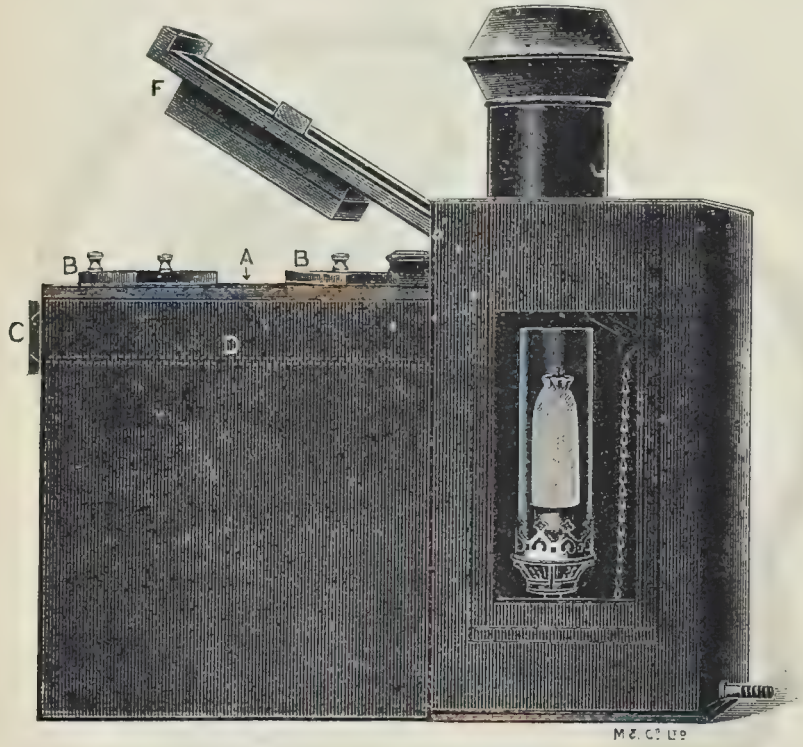
(Sold by Marion and Co., 22-23, Soho Square, London, W.)

The printer before us, which Messrs. Marion call the "Renaud,"



is singularly innocent of anything in the nature of movements or machinery. It is assumed to be one person's work to look after an apparatus of this kind, and therefore the printing of the negative may just as well involve the intervention of some primitive type

of human intelligence, such as may be assumed to be the possession of a hired boy or girl. Things are adjusted at the start by some one of experience, and the cards can then be taken off very rapidly from the negative by anyone who is able (1) to lay a piece of paper in a frame, and (2) count five. The apparatus consists of the box seen in the drawing and containing an electric lamp. Above the latter is a ground glass screen (D shown dotted in the figure), and on the top of the box a ground glass bed, on which a negative up to whole-plate in size can be clamped. The clamping boards, B B, are adjustable for half-plate, cabinet, and postcard sizes, and prints from papers of these dimensions can thus be made from any negative between whole-plate and the smallest sizes. Masks can be placed in the negative and vignettes or the ground glass shelf below. These and all other preliminary operations are performed with the light on, the switch E maintaining contact for this purpose. When ready for exposure, this switch is turned off, and the only way then of switching on the lamp inside the box is by bringing down the pressure board, F, on the card or paper which is laid on the negative. This



movement at the same time cuts off the safelight G, and on pressure being released from the board after sufficient exposure has been given, the board rises, cutting off the light inside and re-establishing that outside. Hence the operator's hands are free to replace a new

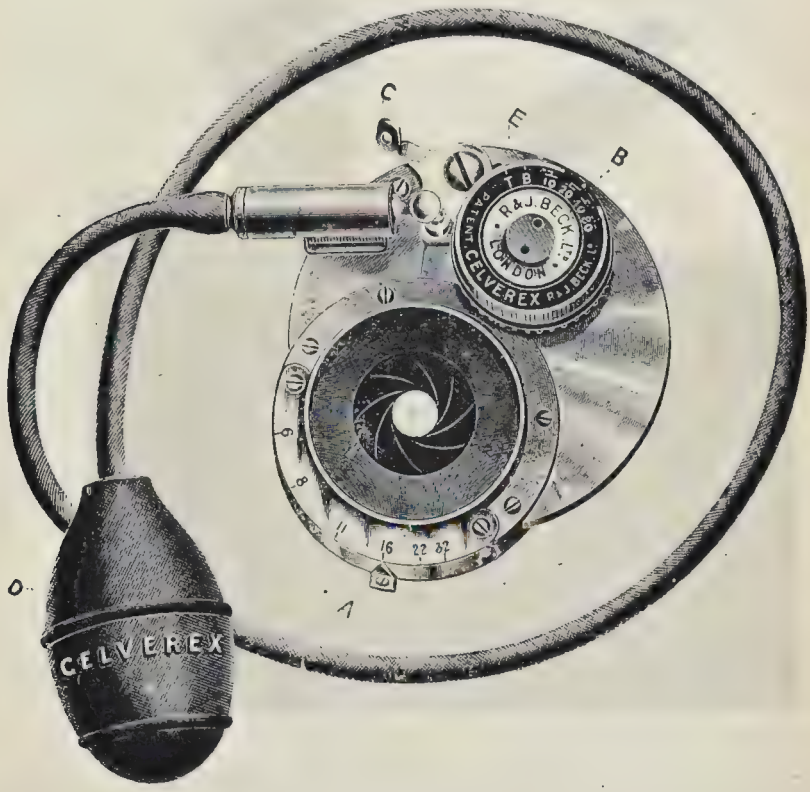
card for the exposed, and to proceed in this way without any loss of time. The apparatus, as we have said, is simple in the extreme, and is sold at the price of 25s. complete, with three masks, pressure boards in five sizes, and wiring, and adapter to fit any household fitting.

The printer is also made in a form for use with an incandescent light, the switch on and off of the light being here made by the very simple lever movement visible in the figure. The average exposure for bromide cards is about one second, the price of the printer in this incandescent gas form being 40s., with three masks and pressure boards, in five sizes, from postcard to half-plate, burner, chimney, and mantle.

THE "CELVEREX" SHUTTER.

(Made by R. and J. Beck, Limited, 68, Cornhill, London, E C.)

In this shutter Messrs. R. and J. Beck have embodied a new and recently patented method of theirs in shutter design to the produc-



tion of a shutter which should correspond accurately with the speed-markings upon it. In the "Celverex" the different speeds are obtained not by putting a greater tension on the driving

mechanism, or by applying a more or less powerful brake, but only by increasing or decreasing the size of the aperture by which the exposure is made, the aperture being enlarged or contracted by rotating a sector plate, the movement of which is directly connected with the scale of the speed numbers. By this device Messrs. Beck provide the user with speeds of 1-10, 1-20, 1-40, and 1-80, in addition to "time" and "bulb" exposures, a sufficient range, it will be admitted, for all ordinary hand-camera work. But the most important feature of the shutter is the accuracy of the speeds which the makers guarantee. Each instrument is tested before it is sent out, and a card of speeds enclosed, showing the difference, usually negligible, from the engraved speeds. In other respects the "Celverex" possesses desirable features. It is thin, light, and therefore may be fitted between the components of a double lens, even of those supplied with the smaller folding cameras. It carries an iris diaphragm, which can be suitably engraved to suit a given focal length of lens, and lastly, the working parts appear to be reduced to such simple proportions that the shutter may be expected to preserve its accuracy of working throughout a protracted period of constant use. The "Celverex" is made in three sizes, for quarter-plate, 5 x 4, and half-plate lenses, at the prices of £1 15s., £1 17s. 6d., and £2 5s. respectively.

NEW "ZAMBEX SKELETONS" FOR DAYLIGHT LOADING.

(Made by R. and J. Beck, Ltd., 68, Cornhill, London, E.C.)

Despite all that the lay press has done, the technalities of photography, we are afraid, are not yet so grafted on to the language that any person could explain precisely what a Zambex Skeleton is, or wherein the old form of skeleton differs from the later one which Messrs. Beck have sent us for review. The Zambex system provides for the exposure and loading in daylight of cut films, which may be purchased *in situ* in the skeleton, or inserted in the empty skeleton by the purchaser. The latter can thus please his fancy as to which make of film he uses, buying the packets as ordinarily placed on the market. Fig. 1 shows the skeleton partly exposed. It consists of a series of black paper sheaths, in each of which a film (A) is placed. These sheaths are enclosed in an envelope with the tags (K) projecting from one end, a metal rim, C, which is attached to the middle part of the envelope, serving to secure the latter to the camera back. To change a film, all that is required is to pull up the foremost of the numbered tags (K), thus drawing the first film from the lower to the upper half of the envelope. The envelope folds double when in the camera, and only need be unfolded to change a film. As fast as the lower end of the envelope is emptied, the upper half is filled, so that the complete thickness of the folded skeleton always remains the same, and a constant pressure is always exerted to press the films up to correct register. Figure 3 shows the attachment of the Zambex Skeleton to the camera, and Figure 4 the skeleton opened out to allow of recharging. The loaded skeletons containing one dozen quarter-plate films are sold at 2s. 9d. per dozen; the used skeletons, as we have already said, serving for the exposure of purchased films. In

ease of working and reloading, and in compactness, the new Zambex is superior to the original pattern. In both the absence of mechanism is a highly commendable feature, and the later issue appears to leave nothing to be desired as regards smoothness of working. Messrs.



Fig. 1.

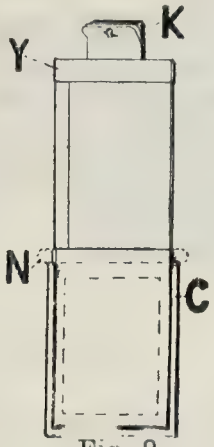


Fig. 2.

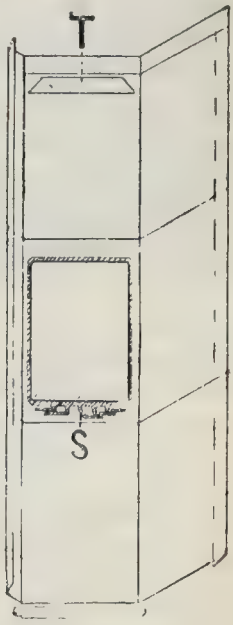


Fig. 4.

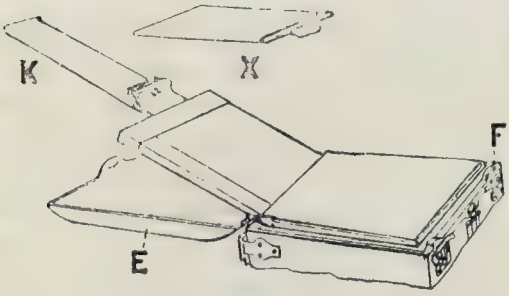


Fig. 3.

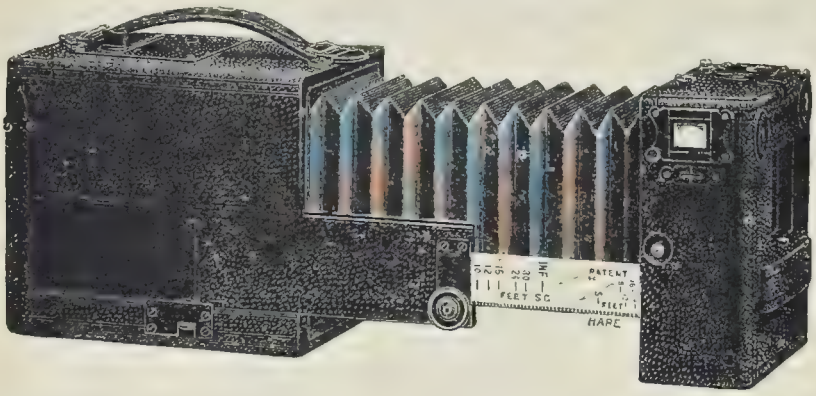
Beck have developed the system very thoroughly by preparing a series of Zambex cameras, accompanied by instructions, capable of being followed by those without any previous knowledge of photography.

THE "ILEX" LONG EXTENSION CAMERA.

(Sold by Houghton and Co., 83 and 89, High Holborn, London, W.C.)

This camera is a long-extension form of the well-known "Ilex" magazine hand camera, than which we know none having a more reliable changing mechanism. The present instrument has sufficient extension for the single combination of the lens to be used. The lever on which the front racks out is engraved with two focussing scales for work at short and long extension, and has all the usual accessories in the shape of finders, shutters, and levels, and is even fitted with two isochromatic screens. The extension of the camera,

when completely racked out, provides a distance of eleven inches from the plate to the diaphragm of the lens.

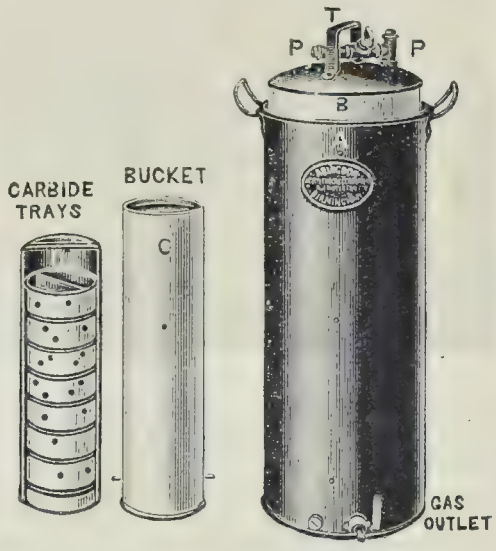


The price in the quarter-plate size, with R.R. lens, working at *f*/6 is £5 10s.; in the 5 by 4 size, £6 10s.

THE "MOSS" ACETYLENE GENERATOR.

(Made by R. J. Moss and Sons, 98 Snow Hill, Birmingham.)

This generator, newly introduced for lantern and enlarging purposes, embodies certain improvements which Messrs. Moss have hitherto employed only in the larger class of apparatus made by



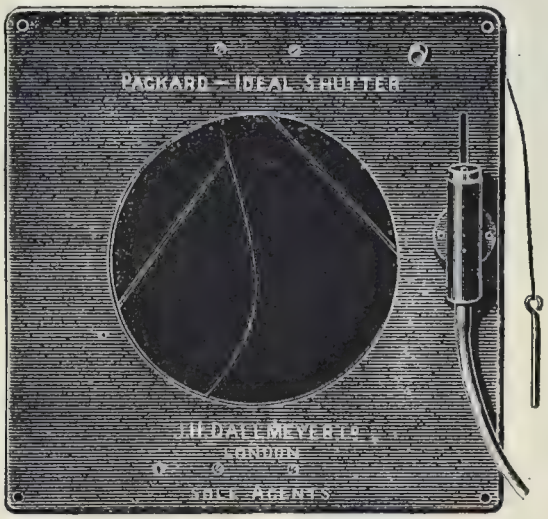
them for house lighting. The carbide trays are not perforated at the bottom, as usual, but only by the small holes shown in the figure, the gas thus being very slowly generated and with considerable diminution of the production of steam.

Further, the cross-pipe P.P., connecting the inner chamber with the main gasholder, is fitted with movable plugs, so that the piping can be easily cleaned, a point which will be appreciated by those who have had trouble through this part of the acetylene apparatus becoming choked. The apparatus is obtainable in two patterns, square and round, and two sizes, 1½ lbs. and 2½ lbs. charge, the prices ranging from 22s. 6d. to 35s.

PACKARD IDEAL SHUTTERS.

(Sold by J. H. Dallmeyer, Ltd., 25, Newman Street, London, W.)

These shutters, which are made primarily for time exposures behind the lens in the studio, are all of the uniform thinness of three-fifths of an inch, and are obtainable in fourteen sizes, from 1½ inches to 5 inches diameter of opening, the outside dimensions of these two extremes of the series being 3½ inches and 9½ inches square. The shutter is normally closed, opens upon the gentlest pressure of the bulb, and closes again on pressure being released. The sound



made in the process is very slight, and when enclosed in a camera, as it must be for use, the mechanism is practically silent. For studio work it should prove popular, as it is difficult to conceive of any shutter which can be more readily fixed inside a camera.

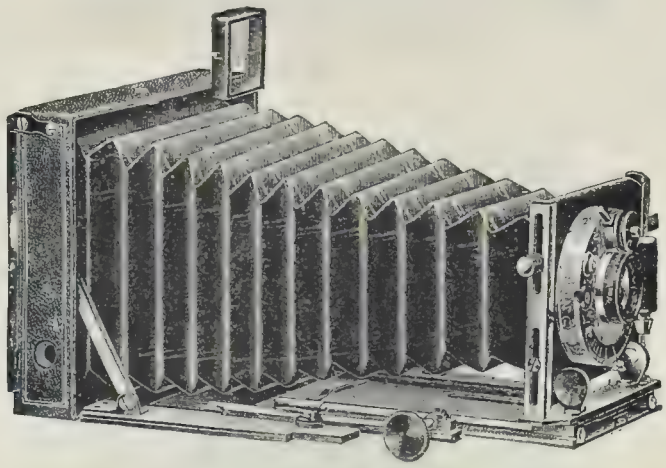
If the lens projects at all into the interior of the camera, circular packing can be inserted and the shutter still screwed to the inside surface of the front of the camera. The thinness of the shutter is in its favour for wide-angle work, such as architecture, as it "cuts off" scarcely at all. For long exposure work the bulb of the shutter is fitted with a plug, which, when removed, allows the shutter to remain open as long as desired. A small pin is provided, and

this, when inserted from the outside of the camera into the shutter, converts the time exposure into an instantaneous one, a brief exposure, apparently of about one-twentieth of a second, resulting on pressure of the bulb. The prices of the shutter range from about £1 for the smallest size, given above, to £1 12s. 6d. for the largest. Those with instantaneous attachment are priced at from £1 7s. 6d. to £2 5s.

THE ALPINE CAMERA.

(Made by Voigtlander and Son, 12, Charterhouse Street, London, E.C.)

The above is a folding hand-camera, made entirely of metal, and of long extension, being thus suitable for use in tropical climates and for many varied requirements of tourist photography.



The camera extends to 8½in., and possesses a rising front and direct brilliant finder, which automatically moves into position when the camera is opened. Its external measurements are 6in. by 4¼in., and the camera is 1½in. thick. The price, with Series III. "Collinear" lens, "Koilos" shutter, and six single dark-slides, is £9.

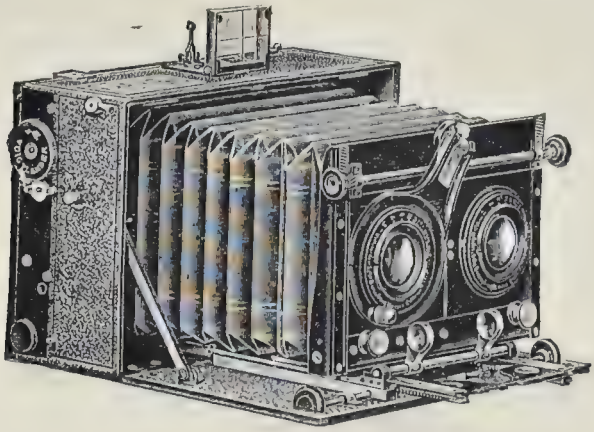
THE "VOIGTLANDER" STEREO-PANORAMIC CAMERA.

(Made by Voigtlander and Son, 12, Charterhouse Street, London, E.C.)

This camera is of general design, similar to the "Alpine," and is made to take 3½in. by 5½in. negatives (9cm. by 14cm.). The extension of the apparatus, 10in., permits of the single combination of lenses being used. For stereo work it is employed at the short extension, but the front board provides for either of the complete lenses being used as a wide angle, or for a single component being employed for long-focus work.

The camera is fitted with focal-plane shutter, rack, and pinion, and rising front, and is made throughout substantially of light aluminium alloy. A separate attachment is sold by the makers for

converting the camera into a twin-lens instrument, one of the pair of stereo lenses being attached to an additional bellows body

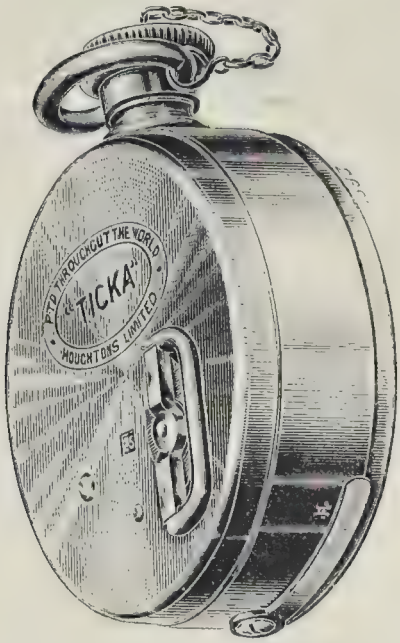


erected above the instrument. The price, including two "Collinear" lenses, Series II., *f*/5.4, and three dark slides, is £21.

THE "TICKA" CAMERA.

(Sold by Houghton and Co., 88 and 89, High Holborn, London.)

Under this title Messrs. Houghton have introduced a watch-form



camera, taking roll film sufficient for twenty-five exposures, and giving negatives which, when enlarged to about 3in. by 2in., yield

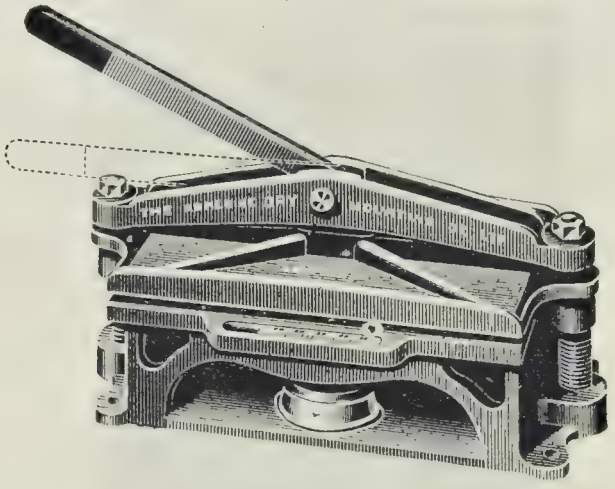
quite excellent little prints. The camera measures 2¾in. diameter, and is under an inch in thickness. It is provided with time and instantaneous shutter and cap for lens, which is placed in the handle of the watch.

The tiny negatives measure 1in. by ½in., and the apparatus, though so compact, is nevertheless better than a toy, for the depth of focus given by a lens of such short focal length is very great, and the negatives will therefore stand enlargement well. The price of the "Ticka" is 8s. 6d., and Messrs. Houghton supply numerous accessories in the shape of printing papers, mounts, albums, etc.

DRY MOUNTING MACHINE.

(Sold by the Adhesive Dry Mounting Company, Limited, 27-28, Fetter Lane, London, E.C.)

This machine is placed on the market for the amateur worker. The company have several machines specially designed with a view to professional work, but in the present machine they offer for 25s. a complete outfit, by which an amateur can dry-mount prints up to whole-plate in size. The set includes the press, thermometer, spirit lamp, fixing-iron, two mounting covers, and a grey mounting board. The machine, as will be seen from the drawing, works by the operation of an eccentric cam, and communicates an even pressure quickly



and without any mechanism which can become deranged. Of the process itself it is unnecessary for us to speak in terms of commendation. The method of attaching the print to its mount by a solid and insulating "tissue" of lac substance is not likely to be improved

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Owing to a portion of the ALMANAC *having to be made up before the whole is completely paged the numbers of thirty-two pages* (907 *to* 938) *have had to be omitted at this point, from the sequence of pagination.*—ED., B.J.A.

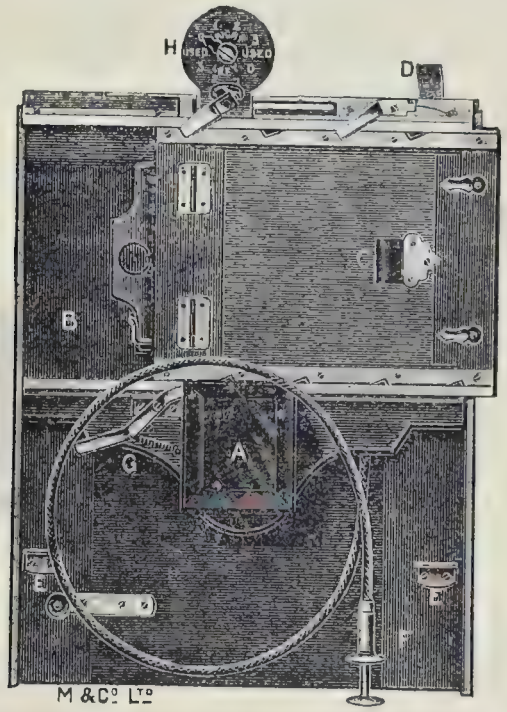
upon, providing, as it does, the absolute flatness of the print on the thinnest mount, the perfect adherence of the two, and the protection of the print from any deleterious constituents of the mounting board. The only drawback to the process has hitherto been the very considerable outlay for a proper press. This obstacle the company have now removed in the small press before us, and in a larger one, for professionals, sold at £2 10s. A circular of the company's, to be obtained at 27, Fetter Lane, will show the very simple and expeditious procedure in employing the press and tissues.

Since the above outfit was placed on the market the price of the lac tissues has been very considerably reduced.

THE "SOHO" REPEATING-BACK.

(Sold by Marion & Co., Ltd., 22 and 23, Soho Square, London, W.C.)

A very convenient back for midget photography has been introduced by Messrs. Marion, under this title. Its construction and mode of use will be explained by the drawing without many words of explanation. The dark slide, to which a focussing screen is attached, has



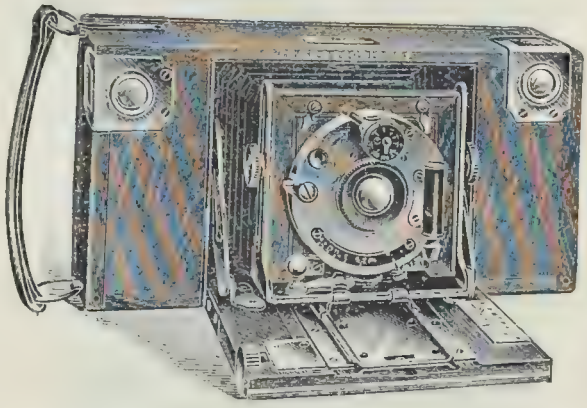
its two-way movement (across, and up and down the plate), supplemented by the movement of the slide in its horizontal guides in either direction. As a result, the manipulation of the apparatus exacts very little from the operator in the way of attention after focussing—the figure shows the apparatus at this stage. The slide

carrier is pushed down to the stops EE, and the camera is then ready for the first exposure when the shutter is withdrawn. The slide is then drawn to the left, exposing the lower half of the quarter-plate contained in it in three stages, which are duly registered on the dial. The slide is then reversed in position and the (previously) upper part of the plate similarly exposed. The mechanism of the attachment appears to us to be commendably free from complications in its working parts, and the apparatus should certainly prove reliable in practice. The back can be fitted to any half-plate or whole-plate camera, and costs, including fitting, £3 5s. Extra dark slides are supplied at 10s. A half-plate size of the back is obtainable.

PORTABLE POSTCARD CAMERAS DE LUXE.

(Sold by the London Stereoscopic Company, 106 and 108, Regent Street, London, W.)

Specially for the use of photographers abroad, living under trying climatic conditions, the London Stereoscopic Company have produced two cameras of the highest class, which should answer the requirements of those desiring portable cameras of the finest description. They are named the "Service" and the "King's Own." The former takes a picture 5¼ by 3¼. postcard size, has an extension of ten inches, and is fitted in the example submitted to us with the Goerz "Dagor" of *f*/6.8 aperture. It carries the well-known "Koilos" shutter, large reversible finder, and is fitted with considerable rising and cross front movement.

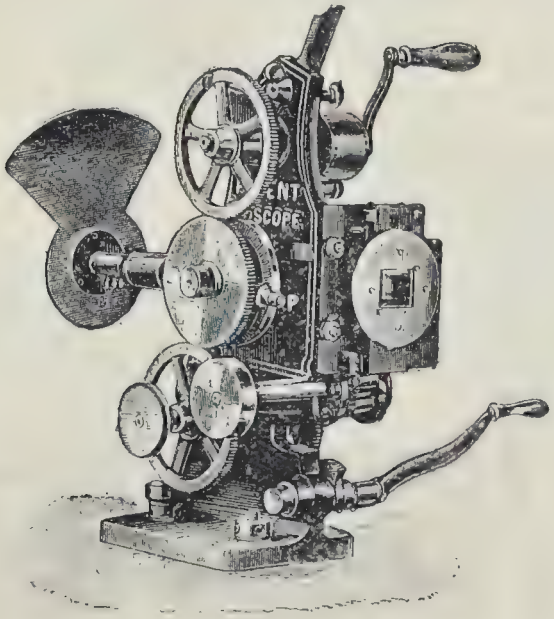


The body of the camera is made to take either roll-film or plates, the dark slides for the latter being used without the necessity of an extra adapter. A focussing screen is also provided. The substantial build of the camera leaves nothing to be desired, and both it and its fellow, the "King's Own," may be recommended for presentation purposes. The latter is also of postcard size, but handsomely made in teak, with the essential working parts brass bound. Like its fellow, it accommodates both plates and films, and is in every way an apparatus of the finest order, both from the practical point of view and in appearance.

THE "PERFECT" PROJECTOR.

(Made by R. R. Beard, 10, Trafalgar Road, Old Kent Road, London, S.E.)

This cinematograph projector embodies a number of features which should recommend it for exhibition work. The construction obviates the need of shifting the film on the sprockets or of displacing the lens. The dog bearing is made on a bracket swinging from the sprocket wheel bearing, the shutter and dog being made to work in unison. Thus no movemert of the lens or gate is required, the films being brought into position with the gate aperture by raising or lowering the handle H.



In other respects, also, the mechanism of the instrument is specially made for reliable action. The price, with top-arm, re-winding gear, coiled wire belt, and automatic cut-off, is £18 18s.

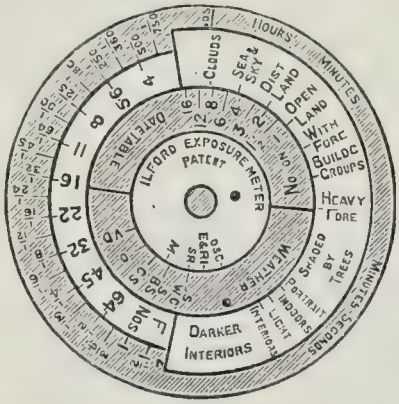
THE ILFORD EXPOSURE METER.

(Sold by Ilford, Limited, Ilford, E.)

A new pattern of the Ilford meter, embodying recent patent protection, has now been placed on the market by the Ilford Company, and is an extremely complete guide to the exposure of the company's well-known brands of plates. It provides for the factors in exposure of plate-speed, subject, and diaphragm, and light, the latter being calculated on the basis of Dr. Scott's well-known tables, in conjunction with a scale for weather conditions ranging from S (sunlight) to V.D. (very dull). Though the meter consists of four concentric discs, the operations in calculating the exposure are but three in number:—

1. Set weather condition opposite plate.
2. Look out light figure in table of time of day and year.
3. Set subject opposite light figure.

The exposure for every diaphragm from *f*/4 to *f*/64 is then shown at once. The user can scarcely go wrong in this very simple procedure, since the three sets of scales are printed each in a different colour,



and black must be set only to black, blue to blue, and red to red, when using the meter. This device is a great advantage in placing the meter in the hands of persons unacquainted with such forms of calculators, and should be sufficient to safeguard the meter perfectly from misuse. In such other respects, as compactness—the meter is but 2½in. in diameter—and its ability to respond to the most varied photographic circumstances, the meter commands our warm approval. The price in cardboard is 1s.; in aluminium, 5s.; and the one instrument in conjunction with the additional light tables is ready for use in any part of the world.

NEW PLANASTIGMAT LENSES.

(Sold by A. E. Staley and Co., 19, Thavies Inn, Holborn Circus, London, E.C.)

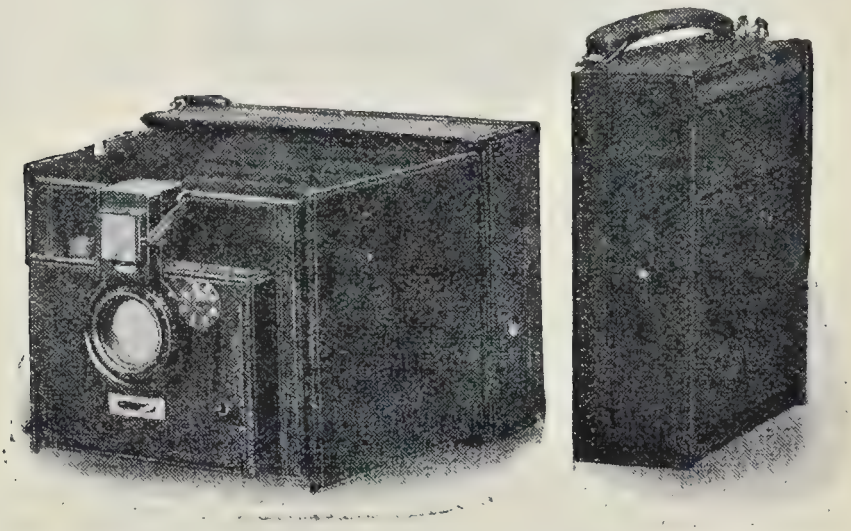
A new series of these lenses has been placed on the market by Messrs. Staley, in which an angle of 90 degrees is obtained by the use of the double combination of uncemented glasses. Each single lens can be used alone, giving an objective of about double the focal length of the complete lens. The largest aperture is *f*/6.8, at which we have found the lenses to give exceedingly good definition over the above angle; and the series is very suitable for groups, architectural work, and general photography, where good definition over the whole field is a necessity. The sizes in which the lenses are made are as follows:—

No.	Focus.	Full Aperture.	Covers full Aperture.	Covers Stopped Down.	Price.
0	4¾ in.	23/32	3½ × 4¾	7 × 5	55/-
1	6 ,,	7/8 in.	4¾ × 6½	8¼ × 6¼	65/-
2	7⅛ ,,	1, 1/16 in.	7 × 5	9½ × 7	75/-
3	9½ ,,	1⅜ in.	9 × 7	12 × 10	115/-

THE "IDENTO" HAND CAMERA.

(Made by Adams and Co., 26, Charing Cross Road, London, W.C.)

Since our notice of the quarter-plate "Idento" last year, Messrs. Adams have issued a similar camera in the 3½ by 2½ size, instruments of which dimensions are gradually winning their way to popularity, for the reason that such an apparatus can be made of absolutely pocket size, and the picture is almost equal to the quarter-plate, and is even its superior if the final destination of the picture is an enlargement. The "Idento," in this new size, measures externally only 4½ by 3½ inches, and is almost exactly an inch and a quarter thick. Like its quarter-plate predecessor, it has all the movements of a complete camera, a rise of front each way of the plate being obtained by the turntable lens-and-shutter-panel. The feature of the camera is, of course, the finder which registers, when the front is raised or lowered, precisely the picture which is obtained on the plate.



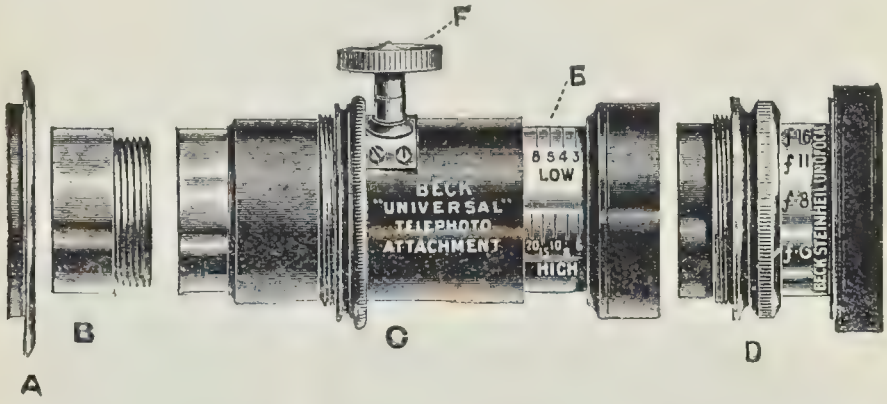
This movement is obtained very simply in the camera by a lever attachment to the lens of the finder. The camera is made to carry the thinnest single dark slides or the Kodak film pack, a special adapter being supplied for the latter by the maker. The price of the instrument, with anastigmat lens working at *f*/6.3, is £10 10s.; and the camera is also to be issued in the half-plate size at £15 15s., without a lens.

THE BECK TELEPHOTO ATTACHMENT.

(Made by R. & J. Beck, Ltd., 68, Cornhill, London, E.C.)

Under the title of "Universal," Messrs. Beck are supplying three series of telephoto attachments, suitable for use with any good lens. The lens is screwed into the head of the attachment, the latter, in turn, being attached to the lens flange. The tube of the attachment carries a scale, showing the point to which the lens must

be set for any given magnification, and the makers are further supplying an attachment carrying the two scales, the lenses of the telephoto being interchangeable, so that the same attachment will enable the photographer to use the whole system as one of either high or low power. This facility means that he may obtain magnifications of from 3 to 5, or of from 7 to 20, without burdening himself with a separate telephoto mount.



The mount and the two lenses are supplied complete in a case, and a light-filter for orthochromatic work may also be included in the same outfit. Messrs. Beck's full price list should be consulted for the powers of these attachments, suitable for lenses of different focal lengths; but as an idea of the price we may mention that the standard power (magnification of from 4 to 8) costs, for a lens of 5½ to 7½ inches focal length, £3 7s. 6d.; a high-power lens, approximately between these same limits, will be £3 5s. The pair above alluded to, including the rack and pinion mount and two interchangeable telephoto attachments for high-power and low-power work, costs, complete in case, £5 2s. 6d.; or with a "Unofocal" positive lens, in addition, working at *f*/6, £8 17s. 6d. The mechanical construction of the mounts is excellent, being quite of the character which one would expect of a firm of Messrs. Beck's reputation; and the above outfits, at their moderate prices, should overcome the monetary objections of many photographers to telephoto work.

THE "SICKLE" MERCURY-VAPOUR PRINTING APPARATUS.

(Sold by O. Schel and Co., 52, Bunhill Row, London, E.C.)

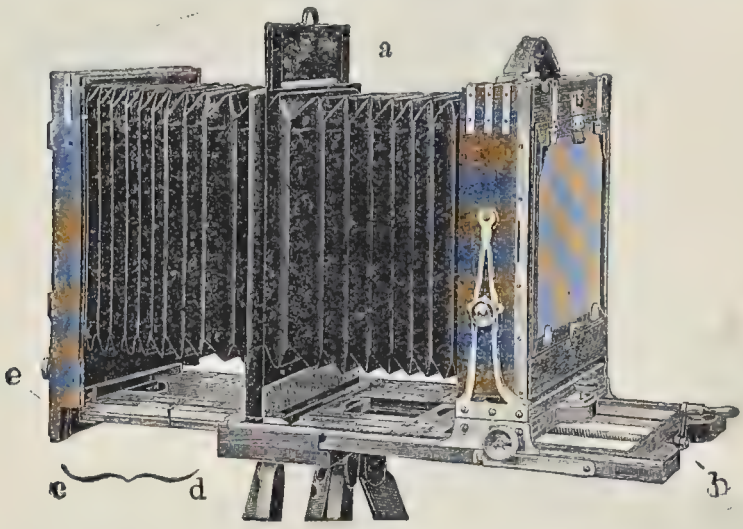
The apparatus utilises the now well-known mercury-vapour light, very suitable for the purpose, owing to its great actinic power and absence of heat. The printing outfit is sold in two sizes, the smaller enclosing one lamp and the larger three. The single-tube installation accommodates twelve half-plate printing frames; the larger apparatus has the advantage that it can be employed for large and small frames, having a capacity of twenty-four half-plate frames or a smaller number of larger ones, and *vice versâ*. Although placed

close to the tube, the equality of the light over the frames is remarkable, and the heating is practically nil. The speed of printing is from ten minutes on P.O.P., according to the density of the negative, but with this time, which is that for a clean, quick printing negative, the capacity of the apparatus is quite sufficient to keep a printer busy. The needed current, which must be continuous, not alternating, is one-half unit on a 200-volt circuit per hour, representing a cost of running which prospective purchasers can work out for themselves from the day charges for their local supply. The construction of the apparatus is convenient and compact, and we have no doubt that Messrs. Sichel will find many customers among the professional classes. The price of the installation, complete with lamps, resistances, and induction coil, is £6 10s. for the one-tube size and £11 for the three-tube. Extra tubes cost 30s. each.

THE TELE-PARTITION CAMERA.

(Made by Voigtlander and Son, 12, Charterhouse Street, London, E.C.)

This camera is one specially made for telephotography, but applicable also to many purposes of indoor and outdoor photography. Its special feature is the portion (*a* in the figure) which serves to carry the telephoto negative attachment, the positive lens being mounted in the usual way on the camera front. The tele-partition is fixed to the base-board, the camera front being racked from it by a winch, and the back by a rack and pinion.



The total extension is 16in., and the camera is fitted with a rise of front of 1½in. and ample cross-front movement. The partition, as shown in the figure, is removable from the outside of the camera. The price of the apparatus in half-plate size (13cm. by 18cm.) is £11, inclusive of three double dark-slides. When folded the camera measures 10½in. by 8¼in., being 3½in. in thickness.

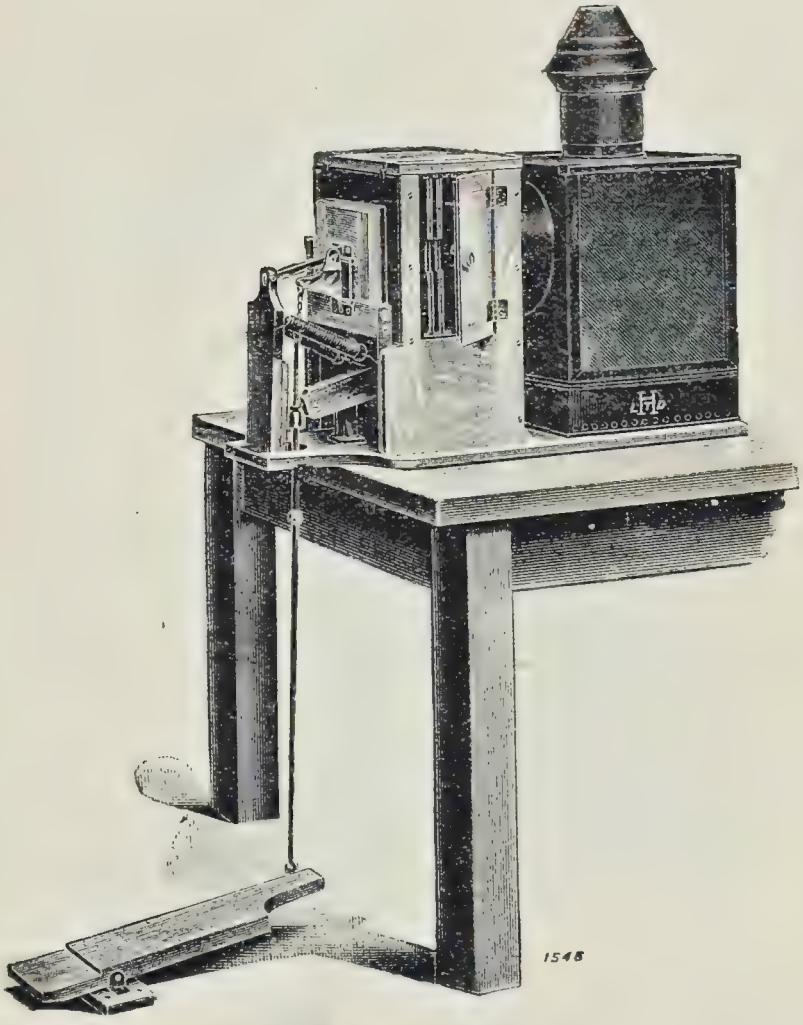
THE "HANA" BROMIDE PRINTING MACHINE.

(Made by Houghtons, Ltd., 88, 89, High Holborn, London, W.C.)

Among the good points of this machine, from a practical point of view, we signalise the following as of primary importance for rapid work:—

The negative is changed and fixed firmly in position in a few seconds.

In feeding sensitive paper or cards to the machine, each piece is



placed instantly into exact register, a large edition of prints being uniformly identical.

These, as we have said, are the two chief qualifications for rapid work. The reader will gather from them and from the illustration that the "Hana" is a hand-fed machine—the type of bromide printer which is proving itself the most capable of responding to

every-day work, for the reason that it is free from complicated mechanism, that every operation is under inspection, and that changes in the brand of printing material, in the portion of the negative to be utilised, or in other respects can be instantly recognised as necessary, and as quickly made.

As will be seen from the drawing the "printing frame" portion of the machine is the face of the wooden chamber (Fig. 1), having a door on the right. This face is glazed, and the negative is held firmly against it by the hinged frame immediately below the pressure back. The negative—which may be whole-plate or the very smallest—is centred over the opening, and on being fixed by a turn of a lever below the frame will give print after print exactly corresponding to the opening of the cut-out.

In making each print the paper or postcard is placed against two stops, and pressure applied to the footboard with the heel. This movement closes the back against the paper, and lowers the ruby window separating the light. To arrest exposure, the heel pressure is released, and the other end of the footboard pressed down with the toe, cutting off the light and opening the back. This series of exposures goes on as fast as the papers can be fed in, both hands being at liberty for handling the cards, and the exposures being controlled entirely by the foot. The chamber between the negative and the light is grooved to receive ground glass or opal when working with rapid bromide papers, and for the reception of a vignetting table, which is provided with a large aperture, over which a suitably pierced card is held by a couple of springs, being adjusted to the negative while the effect to be obtained is in sight. On our paying a visit to his studio, Mr. Hana himself showed us the delicacy of the vignettes obtained in this way, and at the same time allowed us to see the machine doing its daily work in a way which entirely confirms us in what we have written of it.

We have written much, and yet not more, we feel, than this work manlike and strongly-made piece of apparatus deserves. It is pre-eminently fitted for its work, is capable of giving with great rapidity prints which lack nothing as regards sharpness and correspondence with that part of the negative selected. The machine as now issued makes prints up to half-plate size, but will take negatives up to whole-plate. The lantern portion is provided with a ruby and orange window on either side, affording a safe light for development of plates and papers. The complete apparatus costs £4 15s., complete with incandescent burner, and can be supplied also for oil or electric light.

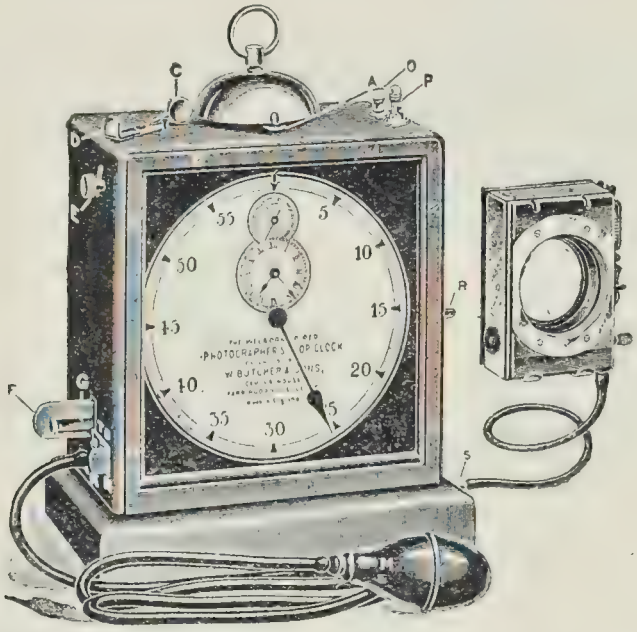
THE WELBORNE PIPER PHOTOGRAPHERS' STOP CLOCK.

(Sold by W. Butcher & Sons, Camera House, Farringdon Avenue, London, E.C.

This instrument has been introduced, not only for the so-called "time development," but for many other photographic operations the accurate control of which in regard to time will be accompanied with advantages in the matters of quality and regularity. The mechanism and adjustments of the clock are a little difficult to explain, but reference to the diagram should make clear the facilities

which it offers in aiding the photographer to time his operations in the dark room.

There are two ways of setting the clock for use. It may be arranged to work by "time" or "bulb." The former we find the more convenient method, but care should be taken by users to familiarise themselves with both if they would understand the working of the clock and be able to avail themselves of all its movements. To set for time, the bolt H is pushed in towards the letter T on the wooden case of the clock, and the clock then stopped either with G or with the automatic stop E. Sharp pressure on the bulb, or on the lever F, will now cause the clock to start, and it will



F. Starting lever.
H. Bolt by which the setting of the clock is made either "time" or "bulb," *i.e.*, by which the clock will either continue going after the lever F has been depressed and released, or will go only while F is kept down.
M. Pneumatic bulb for release to replace the lever F and answering in the same way to the movement of the bolt H.
G. Stop-lever, pressure on which stops the clock.
D. Gong-lever, to permit of, or prevent, the minute gong from striking.
E. Automatic stop. On turning the screw downwards the seconds hand of the clock is arrested at the zero position.

continue to go until stoppel, striking the gong at every completion of the minute—that is, at every time the seconds hand reaches the zero point. A second pressure on the bulb stops the clock only for the time the bulb is kept pressed. To stop the clock permanently the lever G must be depressed.

For the so-called "ball" setting the brass bolt H is pulled towards the letter B marked on the wooden case. The clock then starts upon the bulb or the lever H being pressed, and continues running only as long as either is kept pressed. The clock thus set to "bulb"

behaves just like a photographic everset shutter also set to "bulb."

The above description, perhaps, will scarcely fulfil the purpose we have in writing it—viz., to show the ease and convenience with which the clock is used. Perhaps we can do this better by pointing out the application of the instrument in practical photography. Take first the "timing" of development by the Watkins factor method. The clock is set to "time," and the bulb of the release placed beneath the worker's foot, the 4ft. length of tubing permitting of this being done. The clock is started from zero, the moment the developer is poured on, by sharply pressing and releasing the bulb, and the clock is arrested by pressure on the bulb the moment the image appears. The number of seconds which have elapsed during the appearance of the image can thus be read off accurately to half a second, and the total time of development thus obtained with equal accuracy.

Next, take the case of such work as copying, photographing with the microscope, etc., where the exposure may have to be interrupted several times in order to avoid vibration from passing vehicles. The bulbs of the shutter and the clock can be pressed simultaneously, and the intermittent exposures thus made conveniently, whilst the clock adds up the separate times and prevents the occurrence of errors which are most difficult to avoid if the exposures are made with an ordinary watch. The clock and shutter, if preferred, can be worked off one bulb by providing a T-piece, but this addition is not absolutely necessary.

One other attachment of the clock must be mentioned as now embodied in the present instruments. The operator is enabled to (1) terminate a prolonged time exposure; (2) give an instantaneous exposure (or short time exposure, according to shutter used) at any prearranged time. The price of the clock is 30s.

FORMULÆ FOR THE PRINCIPAL PHOTOGRAPHIC PROCESSES.

DEVELOPING FORMULÆ FOR GELATINE DRY PLATES, ETC.

(*Arranged alphabetically.*)

The following are a few of the typical formulæ generally employed for development, etc. A much greater variety will be found in the section headed "Developing Formulæ of the Principal Plate-makers" (pp. 1,000 et seq.). In these as in other formulæ in the ALMANAC "sodium sulphite" without qualification refers to the "cryst" and "recryst" sulphite, and "sodium carbonate" to the crystallised carbonate.

It should be noted also that the metric weights are not equivalents of the British item for item, but that the two formulæ give a solution of the same composition.

ADUROL.

TWO-SOLUTION.

A. Adurol	85 grs.	19·5 gms.
Sodium sulphite	1¾ ozs.	175 ,,
Water	10 ,,	1000 c.c.s.
B. Potass carbonate	1¼ oz.	125 gms.
Water	10 ozs.	1000 c.c.s.

For studio work and snap-shots take 1 part of A, 1 part of B.

For time exposures outdoor take 1 part of A, 1 part of B, 1 part of water.

ONE-SOLUTION (CONCENTRATED).

Sodium sulphite	4 ozs.	400 gms.
Potass carbonate	3 ,,	300 ,,
Water	10 ,,	1000 c.c.s.

When all are dissolved add—

Adurol...	½ oz.	50 gms.

For studio work and snap-shots take 1 part with 3 parts of water.
For time exposures outdoor take 1 part with 5 parts of water.

AMIDOL.

A normal developer consists of—

Amidol	2—3 grs.	4·5—7·0 gms.
Sodium sulphite	25 ,,	57·5 ,,
Water to	1 oz.	1000 c.c.s.

The mixed developer will keep well in solution for about a week, or sometimes longer, if its concentration does not exceed that given above. It must be made up with freshly dissolved sulphite as this salt does not keep well in solution for more than a few weeks. A sodium sulphite solution that has been made neutral to litmus by the addition of potassium metabisulphite will, however, keep well for a very long period, and by the addition of dry amidol a fresh developer can be rapidly prepared when required.

Make the following stock neutralised sulphite solution:

Sodium sulphite	4 ozs.
Potassium metabisulphite	1 oz.
Water to	20 ozs.

For use take—

Amidol	2—3 grs.	4.5—7.0 gms.
Stock sulph. sol.	100 mm.	200 c.c.s.
Water to	1 oz.	1000 c.c.s.

ILFORD AMAUTO
Self-Developing Plates
Easiest Plates in the World
No Developers to compound or mix. No Chemicals to carry about. No troubles, worries, or failures.
Full Price Lists post free on application.
ILFORD, Limited, ILFORD, LONDON, E.

DIOGEN.

Concentrated Solution.

Sodium sulphite	8 ozs.	400 gms.
Diogen	2 ,,	96 ,,
Distilled water	20 ,,	1000 c.c.s.
Potassium carbonate... ...	10 ,,	500 gms.

For correct exposure mix :—

Concentrated solution ...	4 drachms	14 c.c.s.
Water	17 ,,	60 ,,
Potassium bromide 10 per cent. solution	2 drops	2 drops

Chemically, diogen is the acid sodium salt of an amido-naphthol-disulphonic acid.

EDINOL.

ONE-SOLUTION.

Water	20 ozs.	1000 c.c.s
Sodium sulphite	5 ,,	250 gms.
Edinol	96 grs.	11 ,,
Sodium carbonate	2 ozs.	100 ,,

For soft portrait negatives.

Water	20 ozs.	1000 c.c.s.
Acetone sulphite (Bayer) ...	288 grs.	33 gms.
Sodium sulphite	4 ozs.	200 ,,
Edinol	96 grs.	11 ,,
Potassium carbonate	2 ozs.	100 ,,
Potassium bromide	48 grs.	5·5 ,,

For contrasty negatives.

The ingredients should be dissolved strictly in the order given.

EIKONOGEN.

A. Sodium sulphite	2 ozs.	100 gms.
Eikonogen	½ oz.	25 ,,
Distilled water	20 ozs.	1000 c.c.s.
B. Potass carbonate	1½ oz.	75 gms.
Distilled water	20 ozs.	1000 c.c.s.

For use, mix equal volumes of A and B.

ILFORD **Chromatic and Rapid Isochrom Plates**

POPULAR PRICES. The FINEST Isochromatic or Orthochromatic Plates made. **Unapproached in their Rendering of Colour-Values in Monochrome. All Ilford Plates are supplied BACKED (Anti-Halation) to Order.**

Full Price Lists post free on application.

ILFORD, Limited, ILFORD, LONDON, E.

ONE-SOLUTION

Sodium sulphite	2 ozs.	100 gms.
Sodium carbonate	1 oz.	50 ,,
Distilled water	20 ozs.	1000 c.c.s.
Eikonogen	½ oz.	25 gms.

EIKONOGEN-HYDROQUINONE.[1]

A. Hydroquinone	40 grs.	4·5 gms.
Eikonogen	120 ,,	14·0 ,,
Sodium sulphite	480 ,,	55· ,,
Citric acid	20 ,,	2·3 ,,
Water to	20 ozs.	1000 c.c.s.
B. Potass bromide	5 grs.	0·5 gms.
Sodium carbonate	60 ,,	7 ,,
Caustic potash	30 ,,	3·5 ,,
Water to	20 ozs.	1000 c.c.s.

For use, mix in equal parts.

FERROUS OXALATE.

A. Potass oxalate (neutral), 5 ozs. ; hot water, 20 ozs. Cool and pour off clear liquid for use.

B. Warm water, 20 ozs. ; sulphuric acid, 30 minims ; sulphate of iron, 5 ozs.

Mix 1 oz. of B with 3 to 4 ozs. of A (pouring B into A not *vice versa*).

FOR TRANSPARENCIES ON GELATINE-CHLORIDE PLATES.

A. Neutral oxalate of potash ...	2 ozs.	100 gms.
Ammonium chloride	40 grs.	4·5 ,,
Distilled water...	20 ozs.	1000 ,,
B. Sulphate of iron	4 drachms	34 gms.
Citric acid	2 ,,	17 ,,
Alum	2 ,,	17 ,,
Distilled water...	16 ozs.	1000 c.c.s.

For black tones mix the above in equal volume.

ILFORD **Zenith Plates**
(Chocolate and White Label.)

POPULAR PRICES. **FASTEST AND BEST PORTRAIT PLATES.**

Soft Negatives. Exceptional Latitude. No Fog.

Full Price Lists post free on application.

ILFORD, Limited, ILFORD, LONDON, E.

HURTER AND DRIFFIELD'S STANDARD FERROUS OXALATE DEVELOPER (*The Photographic Journal*, 1898).

A. Potassium oxalate	1	part
Water	4	parts
B. Ferrous sulphate	1	part
Citric acid	0·01	,,
Water...	3	parts
C. Potass bromide	1	part
Water...	100	parts

For use take A, 100 parts; B, 25 parts; C, 10 parts. Development to be conducted at a temperature of 65° F.

The ferrous oxalate as compounded above contains in every 1000 parts:—Potassium oxalate, 185 parts; ferrous sulphate, 68·5 parts; citric acid, ·61 parts; potassium bromide, ·74 parts.

GLYCIN.

ONE-SOLUTION (HÜBL).

Boiling water...	4 ozs.	1000 c.c.s.
Sodium sulphite	2½ ,,	625 gms.
When dissolved add—		
Glycin	1 oz.	250 gms.
And then in small quantities—		
Potass carbonate	5 ozs.	1250 gms.

This forms a thick cream, which must be well shaken and then diluted with water; for normal work, dilute 1 oz. with 12 or 15 ozs of water, for very soft results with 30 ozs. of water.

ONE-SOLUTION.

Glycin	1 oz.	33 gms.
Sodium sulphite	2½ ozs.	83 ,,
Potass carbonate	5 ,,	166 ,,
Water to...	30 ,,	1000 c.c.s.

For normal exposures dilute with an equal bulk of water.

HYDROQUINONE.

ONE-SOLUTION.

Hydroquinone	100 grs.	11·5 gms.
Sodium sulphite	1½ oz.	75 ,,
Sodium carbonate	3 ozs.	150 ,,
Water to	20 ,,	1000 c.c.s.

May be diluted with an equal volume of water.

ILFORD PROCESS and HALF TONE PLATES

POPULAR PRICES.

THE BEST PLATES FOR ALL PHOTO-MECHANICAL WORK.

Full Price Lists post free on application.

ILFORD, Limited, ILFORD, LONDON, E.

TWO-SOLUTION (CAUSTIC SODA).

A.	Hydroquinone	160 grs.	18 gms.
	Sodium sulphite...	2 ozs.	100 ,,
	Citric acid	60 grs.	7·0 ,,
	Potass bromide	40 ,,	4·5 ,,
	Water to...	20 ozs.	1000 c.c s.
B.	Caustic soda (stick)	160 grs.	18 gms.
	Water to...	20 ozs.	1000 ,,

For use :—A, 1 oz. ; B, 1 oz. ; water 2 ozs.

ONE-SOLUTION (WITH FORMALINE).

Hydroquinone	130 grs.	15 gms.
Sodium sulphite	6 ozs.	300 ,,
Formaline	3 drachms	20 c.c.s.
Water to...	20 ozs.	1000 ,,

A slow developer specially suitable for line work.

KACHIN.

A.	Kachin	160 grs. (Avoirdupois)	9 gms.
	Sodium sulphite	2½ ozs.	62·5 ,,
	Water to	20 (fl.) ozs.	500 c.c.s.
B.	Sodium carbonate	2 ozs.	50 gms.
	Water to	20 ozs. (fl.)	500 c.c.s.

For use take equal parts of A and B. More diluted developer gives softer results. The solutions should be used at a temperature of 60 to 65 degrees F. Assuming exposure to have been correct, with this solution the image commences to appear in about one minute, and, when full density is required, development is completed in from 4 to 6 minutes. Softer effects are obtained in from 3 to 4 minutes. No restrainer is really necessary, but in the case of over-exposure, the use of a few drops of 5 per cent. solution of ordinary borax is recommended

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IMOGEN-SULPHITE.

A.	Imogen sulphite	1 oz.	83 gms.
	Distilled water (warm) ...	12 ozs.	1000 c.c.s.
B.	Sodium carbonate	1 oz.	500 gms.
	Water	2 ozs.	1000 c.c.s.

For correct exposure, A, 2 ozs.; B, 2 ozs.; water, 4 ozs. For under-exposure or soft negatives, A, 1 oz.; B, 3 ozs.; water, 4 ozs. For over-exposure, A, 2 ozs.; B, 2 ozs.; water, 30 ozs.; potassium bromide, 40 per cent. solution, 1 oz.

METOL.

One-solution (Hauff).

Metol	150 grs.	16 gms.
Sodium sulphite	$2\frac{1}{2}$ ozs.	125 ,,
Sodium carbonate	$3\frac{1}{5}$,,	175 ,,
Potass bromide	16 grs.	2 ,,
Water to...	20 ozs.	1000 c.c.s.

For portraits, take stock solution, 1 oz.; water, 1 oz. For landscapes, stock solution, 1 oz.; water, 2 ozs.

Two solution (Hauff).

A.	Metol	150 grs.	16 gms.
	Sodium sulphite	$2\frac{1}{2}$ ozs.	125 ,,
	Water to...	20 ,,	1000 c.c.s.
B.	Sodium carbonate	$3\frac{1}{2}$ ozs.	175 gms.
	Potass bromide	16 grs.	2·0 ,,
	Water	20 ozs.	1000 c.c.s.

For portraits, A, 1 oz.; B, 1 oz. For landscapes, A. 1 oz.; B, 1 oz. water, 1 oz.

One-solution (Andresen).

Metol	160 grs.	18 gms.
Sodium sulphite	$3\frac{1}{3}$ ozs.	175 ,,
Potass carbonate	$1\frac{3}{4}$,,	87·5 ,,
Potass bromide	22 grs.	2·5 ,,
Water	20 ozs.	1000 c.c.s.

For use, take 1 part of developer to 3 of water.

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TWO-SOLUTION (ANDRESEN).

A. Metol	... 160 grs.	18 gms.
Sodium sulphite ...	... 3½ ozs.	175 ,,
Water	... 20 ,,	1000 c.c.s.
B. Sodium carbonate ...	... 3½ ,,	175 gms.
Water	.. 60 ,,	3000 c.c.s.

One part of A is mixed with 3 parts of B, potass bromide being added as required for prevention of fogging.

METOL-HYDROQUINONE.

ONE-SOLUTION

Metol	... 35 grs.	4 gms.
Sodium sulphite ...	... 2 ozs.	100 ,,
Hydroquinone	... 50 grs.	5·7 ,,
Sodium carbonate ...	... 1½ oz.	75 ,,
Distilled water to ...	... 20 ozs.	1000 c.c.s.

TWO-SOLUTION.

A. Metol	... 40 grs.	4·5 gms.
Hydroquinone	... 50 ,,	5·7 ,,
Sodium sulphite ...	... 120 ,,	14·0 ,,
Potass bromide	... 15 ,,	2·0 ,,
Water to...	... 20 ozs.	1000 c.c.s.
B. Sodium carbonate ...	... ½ oz.	25 gms.
Water	... 20 ,,	1000 c.c.s.

ORTOL.

1. ORTOL-SODA.

A. Ortol	... 140 grs.	15 gms.
Potass metabisulphite ...	... 70 ,,	8 ,,
Water, cold	... 20 ozs.	1000 c.c.s.
B. Sodium carbonate ...	... 2½ ozs.	125 gms.
Sodium sulphite ...	... 3½ ,,	175 ,,
Potass bromide	10—20 grs.	1·1—2·3 ,,
Water	... 20 ozs.	1000 c.c.s.

100 minims of 1 in 2 hypo solution may be added to solution A and is said to brighten the shadows, but this addition is of doubtful value.

In cold weather the potassium bromide may be left out.

For quick development take 1 part of A and 1 part of B. For slow and soft development take 1 part A, 1 part B, and 1 part water.

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PARAMIDOPHENOL.

ONE-SOLUTION.

Potassium metabisulphite ...	6 ozs.	300 gms.
Distilled water	20 ,,	1000 c.c.s.
Paramidophenol	2 ,,	100 gms.

Dissolve in the above order and add gradually—

Caustic soda or potash... ... ... q.s.
to dissolve the precipitate first formed.

For use, dilute 1 oz. with from 10–30 ounces of water.

TWO-SOLUTION.

A. Paramidophenol hydrochloride	200 grs.	23·0 gms.
Potassium metabisulphite ...	100 ,,	11·5 ,,
Distilled water to	20 ozs.	1000 c.c.s.
B. Sodium sulphite	1¼ oz.	62·5 gms.
Potassium carbonate	1¼ ,,	62·5 ,,
Distilled water to	20 ozs.	1000 c.c.s.

For use, mix 1 oz. of A with 2 ozs. of B.

PYRO-ACETONE.

A. Pyro	1 oz.	100 gms.
Sodium sulphite...	4 ozs.	400 ,,
Distilled water to	9 ,,	1000 c.c.s.

Potassium metabisulphite must not be used, unless neutralised and there should be no addition of citric acid.

A normal developer consists of :—

Pyro	4 grs.	9·2 gms.
Acetone	40 minims	80 c.c.s.
Water	1 oz.	1000 ,,

and is made by measuring out 40 minims of A solution, adding 40 minims of acetone and making up to 1 oz.

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PYRO-AMMONIA.

(10% SOLUTIONS.)

A.	Pyro solution as for pyro-potash or pyro-soda		
B.	Potass bromide	1 oz.	100 gms.
	Distilled water to	9 ozs.	1000 c.c.s.
C.	Liquid ammonia (·880) ...	1 oz. (fl.)	100 ,,
	Distilled water to	9 ozs.	1000 ,,

To make a normal developer, take, A, 20 minims ; B, 10 minims ; C, 30 minims ; water to 1 oz. ; or if no bromide is used, A, 20 minims, C, 10 minims, to water, 1 oz.

PYROCATECHIN.

TWO-SOLUTION.

A.	Pyrocatechin	175 grs.	20 gms.
	Sodium sulphite	1½ oz.	75 ,,
	Water	20 ozs.	1000 c.c.s.
B.	Potass carbonate	2½ ,,	125 gms.
	Water	20 ,,	1000 c.c.s.

Equal parts are mixed together.

ONE-SOLUTION.

	Sodium sulphite	5 ozs.	250 gms.
	Water	20 ,,	1000 c.c.s.
	Caustic soda	260–300 grs.	30·0–34·5 gms.
	Pyrocatechin	400 ,,	46·0 ,,

The chemicals are dissolved in this order and the stock solution kept well corked. It is diluted with 20 times its volume of water for use.

PYRO POTASH.

(10 % SOLUTIONS.)

A.	Pyro	1 oz.	100 gms.
	Potassium metabisulphite ...	1 ,,	100 ,,
	Distilled water to	9 ozs.	1000 c.c.s.
B.	Potassium carbonate	1 oz.	100 gms.
	Sodium sulphite	1 ,,	100 ,,
	Distilled water to	9 ozs.	1000 c.c.s.

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A normal pyro potash developer consists of—

Pyro	2–4 grs.	4·6–9·2 gms.
Potassium carbonate	14 ,,	32·2 ,,
Water to	1 oz.	1000 c.c.s.

and is made by taking A, 20 to 40 minims; B, ½ oz.; water to 1 oz. With 5 minims 10 % potass bromide solution if necessary.

PYRO SODA.

(10 % SOLUTIONS.)

A. Pyro	1 oz.	100 gms.
Sodium sulphite	4 ozs.	400 ,,
Distilled water to	9 ,,	1000 c.c.s.
B. Sodium carbonate (cryst.) ...	1 oz.	100 gms.
Distilled water to	9 ozs.	1000 c.c.s.

In the above formula the sulphite should be first dissolved in par of the water, and enough citric acid added to redden litmus pape and then the pyro added and the total bulk made up by the addition o water. The sulphite may be replaced by 1 oz. (100 gms.) of potassium metabisulphite.

A normal pyro soda developer consists of—

Pyro	2–4 grs.	4.5–9 gms.
Sodium carbonate	20 ,,	45 ,,
Water to...	1 oz.	1000 c.c.s.

and is made by taking A, 20 to 40 minims; B, ½ oz.; water to 1 oz. With 5 minims 10 % potass bromide solution if necessary.

The Hurter & Driffield standard pyro soda developer for plate-speed testing is—

Pyro	8 parts
Sodium carbonate	40 ,,
Sodium sulphite	40 ,,
Water to	1000 ,,

PYRO-METOL

A. Pyro	80 grs.	9·2 gms.
Metol	70 ,,	8 ,,
Potass metabisulphite ...	180 ,,	20·0 ,,
Potass bromide	30 ,,	3·5 ,,
Water to...	20 ozs.	1000 c.c.s.

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B. Soda carbonate	3 ozs.	150 gms.
Water to...	20 ,,	1000 c.c.s.

For normal exposures, use equal parts. For under-exposures, increase the proportion of B and add water.

PYRO-CAUSTIC SODA.

(VALENTA.)

A. Pyro	220 grs.	25 gms.
Soda sulphite	3¼ ozs.	162·5 ,,
Water to...	20 ,,	1000 c.c.s.
B. Caustic potash	100 grs.	11·5 gms.
or		
Caustic soda	70 grs.	8·5 gms.
Water to...	20 ozs.	1000 c.c.s.

Take A, 1 oz.; B, 1 oz.; water, 1 oz.

The above is a quick-acting and cheap developer, resembling metol in its characteristics.

RODINAL.

Rodinal is a concentrated liquid preparation of para-amido phenol, sold also in solid form. The following are instructions for the use of the liquid :—

For general work, development of negatives :—Rodinal, 1 oz.; water, 25 ozs. A stronger solution, *e.g.*, Rodinal, 1 oz.; water, 10 ozs., can be used to give density in a shorter time.

For over-exposures :—Rodinal, 1 oz.; water 10 to 15 ozs., with potassium bromide.

For under-exposures :—Rodinal, 1 oz.; water, 30, 40, or 80 ozs

STAND DEVELOPMENT.

Glycin is a very suitable developer for this purpose, and the following directions are given by Hübl for the use of the formula (given on another page) for a concentrated solution.

Normal developer :—Stock sol., 1 oz.; water, 80 to 90 ozs.; potass bromide, 10% sol., 80 minims.

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In this solution a properly exposed plate should make its appearance in 15 or 20 minutes, and obtain full density in several hours.

For under-exposures :—Stock sol., 1 oz. ; caustic soda sol. (10%) 1 oz. ; water, 50 oz,, warmed to 75 degrees F.

For over-exposures :—Stock sol., 1 oz. ; potass bromide, 10% sol. 1 oz. ; water, 25 ozs.

TIME DEVELOPMENT.

The following "Watkins' factors" are abstracted from the instructions for the "Watkins' dark room clock and factorial calculator" :—

SUGGESTED FACTORS.

	Grs. pyro to oz.	Factor.
Pyro-soda without bromide	1	18
	2	12
	3	10
	4	8
	5	6½

	Grs. pyro to oz.	Grs. brom. to oz.	Factor.
Pyro-soda with bromide	1	¼	9
	2	½	5
	3	¾	4⅓
	4	1	4
	8	2	3⅓

Pyro-acetone about double the above figures.

	Factor.
Adurol (Schering or Hauff)	5
Kachin	10
Pyrocatechine	10
Hydroquinone (min. B) ...	5
,, (max. B) ...	4½
Eikonogen	9
Metol	30
Quinomet	30
Glycin (carb. soda)... ...	8
,, (carb. pot.)... ...	12
Amidol (2 grs. per oz.) ...	18
Rodinal	40
Ortol	10
Imogen sulphite	6

	Factor.
Diogen	12
Edinol	20
Diamidophenol	60
Metol-hydroquinone ...	14
Ilford pyro-soda (maximum pyro)	4½
Ilford pyro-soda (minimum pyro)	5½
Imperial pyro-soda... ...	4¾
Imperial standard (pyro-metol)	9
Kodak powders	18
Cristoid developer and film	30

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Matt and Glossy.
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Pyro-soda Developers.

(With and without bromide.)

	Factor.		Factor.
Austin-Edwards (with B) ...	5	Marion (with B)	4½
Barnet (with B)	4¾	Mawson (no B)	10
Cadett (no B)	9	Paget (no B)...	11
Kodak (no B)	12	Thomas (with B)	5
Edwards (with B)	4½	Wratten (no B)	11
Premier (with B)	4½	Wellington (normal) ...	11
Gem (with B)	4	,, (studio) ...	15

COMBINED DEVELOPMENT AND FIXING.

Although there is not much to be said for simultaneous development and fixing on practical grounds, the following formula may be given as one of the best for the purpose :—

A. Kachin	150 grs.	17 gms.
Sodium sulphite	3 ozs.	150 ,,
Water to...	20 ,,	1000 c.c.s.
B. Caustic soda	160 grs.	18 gms.
Water to...	20 ozs.	1000 c.c.s.
C. Hypo	1 oz.	560 gms.
Water to...	2 ozs.	1000 c.c.s.

Take :—A, 160 minims ; B, 24 minims ; C, 20 minims ; water to 1 oz.

General Formula for Developers.

Dr. Lüppo-Cramer gives the following formula—that of the A.G.F.A. for metol—in which the developer proper can be replaced by double the weight of hydroquinone, pyro, adurol, eikonogen, or pyrocatechin :—

A. Developer : soda sulphite, cryst : water = 1 : 10 : 100.

B. Soda carbonate, cryst : water = 1 : 10.

Equal parts of A and B are mixed together.

FIXING, AND HYPO ELIMINATORS.

ACID FIXING BATHS.

Hypo-solution (1 : 5)	50 ozs.	1000 c.c.s,
To which add a mixture of—		
Tartaric acid solution (1 : 2) ...	1½ oz.	30 ,,
Sodium sulphite solution (1 : 4)	3½ ozs.	70 ,,

ALUM-HYPO FIXING BATH.

Alum (saturated solution) ...	20 ozs.	1000 c.c.s.
Sodium sulphite (saturated solution)	4–7 ,,	200–300 ,,
Hypo-solution (1 : 5) ...	20–28 ,,	1000–1250 ,,

CHROME ALUM AND HYPO FIXING BATH.

Add—

Strong sulphuric acid	1 drachm (fl.)	10 c.c.s.
Water	2 ozs.	80 ,,

to—

Sodium sulphite	2 ozs.	80 gms.
Water	6 ,,	240 c.c.s.

And pour the mixture into—

Hypo	16 ozs.	700 gms.
Water	48 ,,	2000 c.c.s.

Finally add to the above mixture –

Chrome alum	1 oz.	40 gms.
Water	8 ozs.	300 c.c.s.

An excellent acid fixer is made by adding about ½ oz. of potass metabisulphite to each pint of fixing bath.

To remove the last traces of Hypo from the Film.

Hydroxyl.

Peroxide of hydrogen (20 vols.)	1 drachm	25 c.c s.
Water	5 ozs.	1000 ,,

After washing the negative well it is immersed for a couple of minutes in the solution and again rinsed in water.

Where peroxide of hydrogen is not obtainable, the following may be used as a substitute :—

Barium dioxide...	1 oz.	25 gms.
Glacial acetic acid	1 ,,	25 ,,
Water	40 ozs.	1000 c.c.s.

Reduce the barium dioxide to a fine powder and add it gradually to the acid and water, shaking until dissolved. A few minutes' immersion in this solution will effectually remove or destroy the last traces of hypo.

Persulphate.

Ammonium persulphate ...	2½ grs.	5 gms.
Carbonate of soda	5 ,,	10 ,,
Water	1 oz.	10 0 c.c.s.

Percarbonate.

Potassium percarbonate ...	2½ grs.	5 gms.
Water	1 oz.	1000 c.c.s.

HARDENING AND CLEARING SOLUTIONS.

HARDENING BATHS.

Formalin ...	1 oz. 50 c.c.s. water	10 to 20 ozs. 500 to 1000 c.c.s.
Alum ...	1 oz. 50 gms. water	20 ozs. 1000 c.c.s.
Chrome alum ...	1 oz. 50 gms. water	20 ozs. 1000 c.c.s.

CLEARING SOLUTIONS.

Acid Alum.

Alum	2 ozs.	200 gms.
Citric acid	1 oz.	100 ,,
Water	10 ozs.	1000 c.c.s.

Wash moderately after fixing, and immerse the negative in the above.

Chrome Alum.

Chrome alum	½ oz.	25 gms.
Hydrochloric acid	½ ,,	25 c.c.s.
or		
Citric acid	1 ,,	50 gms.
Water	20 ozs.	1000 c.c.s.

Thiocarbamide.

Thiocarbamide	90 grs.	10 gms.
Citric acid	90 ,,	10 ,,
Water	20 ozs.	1000 c.c.s.

Sodium Hypochlorite.

Bleaching powder	1 oz.	30 gms.
Sodium carbonate	1½ ,,	45 ,,

Shake up the bleaching powder with a solution of the carbonate in a little water (6 ozs. or 180 c.c.s.), and filter. Extract the residue with plain water and again filter. The filtrate (solution of sodium hypochlorite) forms an active stain remover. It can be acidified with oxalic acid, and then discharges yellow stain still more vigorously, but with risk to the silver image.

Removing Silver Stains.

Soak the negative in—

A. Potass iodide	200 grs.	45 gms.
Water	10 ozs.	1000 c.c.s.

And after washing transfer to—

B. Potass cyanide	300 grs.	70 gms.
Water	10 ozs.	1000 c.c.s.

in which rub the stained part of the film with a pledget of cotton wool.

If the stain does not yield to this treatment, a solution of iodine (in potass iodide) may be used in place of solution A.

NEGATIVE INTENSIFIERS.

MERCURY INTENSIFICATION.

The negative is bleached in the following saturated solution of mercury bichloride :—

Mercury bichloride (corrosive sublimate)	1 oz.	62 gms.
Hot water	16 ozs.	1000 c.c.s.

After cooling this solution and pouring off from the white feathery crystals thrown down, add—

Hydrochloric acid	30 minims	4 c.c.s.

After well washing, the bleached negative is blackened in one or other of the following :—

A. Ammonia (·880)	20 drops	20 drops
Water	1 oz.	30 c.c.s.

Gives great intensification and good black colour.

B. Soda sulphite, 10% solution, made slightly acid with citric acid. Very slightly strengthens a negative.

C. An alkaline developer, such as pyro-soda, pyro-ammonia, hydroquinone, or ferrous oxalate. Gives about double the intensification of B.

D. Schlippe's salt... ...	200–400 grs.	20–40 gms.
Water	20 ozs.	1000 c.c.s.

This solution must be made fresh and gives great intensification.

MONCKHOVEN'S.

1. A. Bromide of potassium... ...	10 grs.	23 gms.
Bichloride of mercury... ...	10 ,,	23 ,,
Water	1 oz.	1000 c.c.s.
B. Pure cyanide of potassium ...	10 grs.	23 gms.
Nitrate of silver	10 ,,	23 ,,
Water	1 oz.	1000 c.c.s.

Place the negative in A till it is white, then rinse and transfer it to solution B. If the intensification has been carried too far, it may be reduced by treatment with a weak solution of hyposulphite of soda.

LUMIERE'S MERCURIC IODIDE INTENSIFIER.

Composition of Normal Intensifier.

Water	20 ozs.	1000 c.c.s.
Anhydrous sulphite of soda...	2 ,,	100 gms.
Mercuric iodide	90 grs.	10 ,,

Instructions for Use.—Dissolve the anhydrous sulphite of soda in the water, then add the mercuric iodide. After intensification in the above solution, the image is washed and then treated with an alkaline developer, such as used for ordinary negative work ; or a 5% solution of sodium sulphide answers as well.

TO RESTORE FADED NEGATIVES.

Mr. W. E. Debenham recommends the following solution for the purpose of restoring printing force to negatives which have faded after mercurial intensification :—

Schlippe's salt	10 grs.	23 gms.
Water	1 oz.	1000 c.c.s.

Wet the film thoroughly by soaking in a dish of water, and immerse in the restoring solution until the desired effect is obtained

SILVER INTENSIFIERS.

J. B. B. WELLINGTON'S FORMULA.

Silver nitrate	120 grs.	7·75 gms.
Water	2 ozs.	60 c.c.s.

Add—

Ammonium sulphocyanide ...	240 grs.	15·5 gms.
Water	3 ozs.	85 c.c.s.

This mixture is best made at the time of use, although it may be left for several weeks. To prepare the intensifier, take—

Above mixture	½ oz.	30 c.c.s.
Hypo solution (1 in 4)	... enough to just dissolve white ppt.	
Pyro (10% sol.) with sulphite	30 minims	4 c.c.s.
Ammonia (10% sol.)	40-60 „	6-8 c.c.s.

Plates should be hardened with alum or formalin, for both this and the following intensifier. When sufficient density is obtained the negative is fixed for a minute or two and washed.

ACID SILVER.

A. Pyro	15 grs.	3·5 gms.
Citric acid	...5-10 „	1-2 „
Water	10 ozs.	1000 c.c.s.
B. Silver nitrate	10 grs.	23 gms.
Water to...	1 oz.	1000 c.c.s.

About 1 oz. (30 c.c.s) of A is poured over the plate, once or twice, about 15 drops of B solution added, and the mixture again applied. Intensification now takes place and the solution is poured off and on until sufficient. If intensifier becomes very thick and turbid, fresh should be mixed up. When dense enough the negative is rinsed, fixed and washed.

CHROMIUM INTENSIFIER

(C. WELBORNE PIPER).

Potassium bichromate	10 grs.
Hydrochloric acid	5 min.
Water	1 oz.

Bleach in above solution, wash until yellow stain is removed, and then develop with amidol.

The process may be safely applied after fixation if the plate is simply rinsed for a minute or so.

COPPER INTENSIFIER.

A.	Copper sulphate	100 grs.	230 gms.
	Water	1 oz.	1000 c.c.s.
B.	Potass bromide	100 grs.	230 gms.
	Water to...	1 oz.	1000 c.c.s.

A and B are separately made up with hot water, mixed and allowed to cool. The negative is bleached in the mixture and washed for a minute or two. It is then blackened in :—

Silver nitrate	45 grs.	100 gms.
Water (distilled)	1 oz.	1000 c.c.s.

For still greater density, the negative is well washed from silver and an ordinary developer applied.

If too dense, after the silver, it can be placed in weak hypo solution (about 10 grs. per oz.) or weak potass cyanide (about 2 grs. per oz.).

LEAD INTENSIFIER.

Lead nitrate	400 grs.	46 gms.
Potass ferricyanide	600 ,,	70 ,,
Acetic acid	3 drachms.	20 c.c.s.
Water to...	20 ozs.	1000 ,,

This stock solution will keep for a long time in the dark. The negative is bleached in it, washed once *very carefully* in 10 % nitric acid—the acid makes the film very tender—then in water, and darkened in :—

A. Sodium sulphide	1 oz.	50 gms.
Water	20 ozs.	1000 c.c.s.

Or in—

B. Schlippe's salt	90 grs.	10 gms.
Ammonia (·880)...	6 drachms	40 c.c.s.
Water	20 ozs.	1000 ,,

Or in—

C. Potass bichromate	1 oz.	100 gms.
Ammonia (·880)...	½ ,,	50 c.c.s.
Water	10 ozs.	1000 ,,

The lead intensifier gives very great intensification and is suited only for line subjects.

URANIUM INTENSIFIER.

A.	Uranium nitrate	100 grs.	23 gms.
	Water to...	10 ozs.	1000 c.c.s.
B.	Potass ferricyanide	100 grs.	23 gms.
	Water to...	10 ozs.	1000 c.c.s.

The intensifier is prepared from :—A sol., 1 oz.; B sol., 1 oz.; acetic acid, 2 drachms.

After washing very completely from hypo, the negative quickly attains density in the above. It must then be placed in several changes of water to remove all yellow colour. A washer, or grooved tank, should not be employed, as it produces patchiness; the plates hould soak in still water. If over-intensified, the whole action can be removed in weak solution of sodium carbonate or ammonia, and if the plate is re-intensified it is well to transfer it from this alkaline bath into weak acetic acid for a few moments, rinsing in clean water before re-applying the intensifier.

NEGATIVE REDUCERS.

FARMER'S.

Hypo solution (1 : 5)	5 ozs.	150 c.c.s.
Potass ferricyanide (10 % sol.)	quant. suff.	quant. suff.

The colour is a fair indication of the strength of the reducer; it should be pale yellow, not orange, and should be used weak rather than strong, since its selective action on the shadows of a negative is then less.

BELITSKI'S.

Potass ferric oxalate	150 grs.	10 gms
Sodium sulphite	125 ,,	8 ,,
Water	7 ozs.	200 c.c.s.

Dissolve and add—

Oxalic acid	40 to 45 grs.	2·5 to 3·1 gms.

and shake until the solution turns green. Then pour off from and undissolved crystals and add:—

Hypo	1¾ oz.	50 gms.

Instead of the ferric oxalate the following more easily obtainable chemicals can be used in the formula:—

Ferric chloride cryst.	100 grs.	6·5 gms.
Potass oxalate	190 ,,	12·5 ,,

PERSULPHATE.

Ammonium persulphate ...	10 to 20 grs.	23 to 45 gms.
Water	1 oz.	1000 c.c.s.

A fresh solution is made at time of use. When sufficiently reduced—indeed, slightly before—the negative is placed at once into 5 % sodium sulphite solution. If much reduction has taken place it is well to fix a second time.

EDER'S (Mercury and Cyanide).

Potassium cyanide	20 grs.	5 gms.
Potassium iodide	10 ,,	2 ,,
Mercury bichloride	10 ,,	2 ,,
Water	10 ozs.	1000 c.c.s.

Reduction takes place slowly and is easy to control.

Dissolve the mercury, then the iodide, and lastly the cyanide to dissolve the red precipitate formed. The solution reduces slowly, but is non-staining.

Iodine-cyanide.

Iodine (10% sol. in potass iodide sol.)	30 minims	6 c.c.s.
Potass cyanide (10% sol. in water)	5 ,,	1 c.c.
Water	1 oz.	100 c.c.s.

Bichromate.

Potass bichromate	180 grs.	20 gms.
Sulphuric acid	7 drachms (fl.)	40 c.c.s.
Water	20 ozs.	1000 ,,

Eder's Method of Reducing Hard Negatives.

Potass bichromate	90 grs.	10 gms.
Hydrochloric acid	1 oz. (fl.)	30 c.c.s.
Alum	1 ,,	50 gms.
Water	20 ozs.	1000 c.c.s.

The negative is bleached through to the back in this solution, well washed and re-developed in any non-staining developer, such as glycin or rodinal, only up to the right degree of contrast.

NEGATIVE VARNISHES.

No 1. Sandarac...	4 ozs.		113 gms.
Alcohol	28 ,,		800 c.c.s.
Oil of lavender...	3 ,,		85 ,,

This is a good varnish for retouching upon, as a tooth is easily obtained by rubbing.

No. 2. White hard varnish	15 ozs.	150 c.c.s.
Rectified spirit (not methylated spirit)	20 to 30 ,,	200 to 300 ,,

This will be found a good and cheap varnish if durability is not required, as it is easily rubbed up for retouching upon and easily cleaned off. Very suitable for enlarged negatives that are not to be retained.

Tough, hard, and durable :—

No. 3. Bleached shellac	1¼ oz.	62 gms.
Mastic	¼ ,,	13 ,,
Oil of turpentine	¼ ,,	13 c.c.s.
Sandarac...	1¼ ,,	62 gms.
Alcohol	20 ozs. (fl.)	1000 c.c.s.
No. 4. Sandarac...	80 ,,	160 gms.
Turpentine	36 ,,	72 c.c.s.
Oil of lavender...	10 ,,	20 ,,
Alcohol	500 ,,	1000 ,,

This one may be rubbed down with powdered resin, and gives a splendid surface for retouching :—

No. 5. Sandarac...	1 oz.	55 gms.
Seed lac	1½ ,,	83 ,,
Castor oil	3 drachms	20 c.c.s.
Oil of lavender...	1½ ,,	10 ,,
Alcohol	18 ozs. (fl.)	1000 ,,

This varnish is somewhat dark in colour.

No. 6. Best orange shellac	2½ ozs.	125 gms.
Oil of lavender or oil of turpentine...	¼ oz.	13 c.c.s.
Methylated alcohol	20 ozs.	1000 ,,

Keep in a warm place until dissolved ; then add a large teaspoonful of whiting or prepared chalk ; shake, set aside to clear, and then decant. This is specially recommended for gelatine negatives.

COLD VARNISHES.

No. 7. Celluloid...	5 grs.	10 gms.
Amyl acetate	1 oz.	1000 c.c.s.

This may be flowed over or applied with a brush to the negative and requires no heat.

No. 8. Zanzibar copal	6 ozs.	30 gms.
Amber (fused)	1 oz.	5 ,,
Ether	60 ozs.	300 c.c.s.
Acetone	40 ,,	200 ,,
Chloroform	4 ,,	20 ,,

No. 9. A good cold varnish is made from equal parts of gold size and benzole. It dries within about 30 minutes and with a surface on which retouching can be well done.

No. 10. 20% shellac solution ...	2 ozs.	160 c.c.s.
Ammonia (·880)...	3 drachms	30 ,,
Methylated spirit	4 ozs.	320 ,,

SHELLAC WATER VARNISH.

Shellac	3 ozs.	100 gms.
Sodium carbonate (saturated solution)	24 ,,	800 c.c.s.

The shellac is allowed to soak in the liquid for 24 hours : the liquor is then poured away and replaced by an equal quantity of water, and the mixture boiled until the shellac dissolves. After standing some time the liquid becomes perfectly clear and bright.

FILM VARNISHES.

The above water varnish is suitable, or the following :—

Borax	300 grs.	30 gms.
Glycerine...	300 minims	30 c.c.s.
Shellac	600 grs.	60 gms.
Water	20 ozs.	1000 c.c.s.

Boil together for about half an hour, then add—

Methylated spirit	5 ozs.	250 c.c.s.

and filter.

Another good varnish for celluloid films is :—

Dammar	500 grs.	115 gms.
Benzole	10 ozs.	1000 c.c.s.

in which, after filtration, the films are immersed and then hung up to dry.

Celluloid in amyl acetate (No. 7 above) can also be used and is an excellent varnish for films.

RETOUCHING VARNISH.

1. Sandarac...	1 oz.	167 gms.
Castor oil	80 grs.	30 ,,
Alcohol	6 ozs.	1000 c.c.s.

First dissolve the sandarac in the alcohol, and then add the oil.

In the above formula the proportions of alcohol must be taken as approximate, as different samples of resins vary, some giving more viscous solutions than others.

2. Pale resin	1 oz.	30 gms.
Oil of turpentine	1 ,,	30 c.c.s.
Oil of lavender	2 ozs.	60 ,,

GROUND-GLASS VARNISH.

Sandarac...	90 grs.	103 gms.
Mastic	20 ,,	23 ,,
Ether	2 ozs.	1000 c.c.s.

Dissolve the resins in the ether and afterwards add—

Benzole	½-1½ ozs.	250-750 c.c.s.

The proportion of the benzole added determines the nature of the matt obtained.

STRIPPING THE FILM FROM GLASS AND CELLULOID NEGATIVES.

FOR GLASS NEGATIVES.

Soak the negative for ten minutes in a 10 per cent. solution of formaline, then rinse and immerse in—

Water	1 oz.	500 c.c.s.
Methylated spirit	1 ,,	500 ,,
Glycerine	20 minims	20 ,,
Hydrofluoric acid	40 ,,	40 ,,

till the film lifts at the corners, then strip from the glass and wash. This solution does not cause the film to enlarge.

FOR FILM NEGATIVES.

Caustic soda	10 grs.	23 gms.
Formaline	10 minims	20 c.c.s.
Water	1 oz.	1000 ,,

The celluloid negative is immersed in this solution until the film shows signs of detachment and can be rolled back with the finger. It is then placed in

Hydrochloric acid	25 minims	50 c.c.s.
Glycerine	25 „	50 „
Water	1 oz.	1000 „

in which it is removed from its original support to a glass or other base.

ORTHOCHROMATIC PROCESSES.

(For gelatine plates.)

Sensitisers for Blue-Green and Green.

Chrysaniline (sat. sol. in hot alcohol)	10 minims	2 c.c.s.
Distilled water	1 oz.	100 „

This reduces the sensitiveness slightly to blue-violet and ultra violet, but sensitises close up to the D line through the green and greenish blue. Time of bathing, 2 to 3 minutes.

Acridine yellow (sat. sol. in hot alcohol)	150—250 minims	30—50 c.c.s.
Distilled water	1 oz.	100 „

This gives greater sensitiveness, which extends from D ½ E to ultra-violet. Unfortunately the gelatine is rather deeply stained, and this can only be removed by alcohol.

Acridine orange N O (Leonhardt's) and benzoflavin II. (Oehler's) also sensitise well, the former up to D, the latter to E only.

Sensitisers for Greenish Yellow and Yellow.

PRELIMINARY BATH.

Ammonia	10 minims	2 c.c.s
Distilled water	1 oz.	100 „

Bathe the plate in this for 2 minutes, then immerse for the same time in—

Erythrosine solution (1: 500)...	30 minims	6 c.c.s.
Ammonia	10 „	2 „
Water	1 oz.	100 „

and dry in the dark. Erythrosine is the best sensitiser for these colours. Naphthofluorescine (Bayer) is also useful, and does not lower the blue sensitiveness so much as erythrosine; a deeper coloured yellow screen is therefore required in practice. A preliminary bath is used as for erythrosine, and the sensitising bath is

Naphthofluorescine (1: 500) ...	60 minims	12 c.c.s.
Ammonia	10 „	2 „
Distilled water	1 oz.	100 „

Bathe for 2 minutes and dry in the dark.

Pinaverdol, one of the new isocyanines, is an excellent sensitiser for bluish green, green and yellow; the method of using it is as follows :—

STOCK SOLUTION.

Pinaverdol	9 grs.	1 gm.
Warm alcohol	12 ozs.	600 c.c.s.
Distilled water	8 ,,	400 ,,

SENSITISING BATH.

Stock dye solution	1 oz.	20 c.c.s.
Liq. ammonia	½ ,,	10 ,,
Distilled water to	50 ozs.	1000 ,,

Time of bathing 3 minutes, then wash for 2 or 3 minutes and dry in the dark.

Panchromatic Sensitisers.

(For gelatine plates.)

The introduction of the new isocyanines has completely revolutionised the methods of sensitising for orange and red. The method of using them is practically the same, and ethyl-red, homocol, isocol, pinachrome and pinacyanol produce almost a closed band throughout the spectrum. Dicyanine, which gives the greatest red sensitiveness, sensitises but slightly for green.

STOCK DYE SOLUTION.

Dye	15½ grs.	1 gm.
Warm alcohol	3½ ozs.	100 c.c.s.
Dissolve and add—		
Alcohol	21 ozs.	600 c.c.s.
Distilled water to	35 ,,	1000 ,,

This will keep in the dark indefinitely.

THE SENSITISING BATH.

Dye solution	68—100 min.	4–6 c.c.s.
Alcohol	3½ ozs.	100 ,,
Distilled water	7 ,,	200 ,,

This solution will keep in the dark for some weeks.

Bathe the plates for 3 or 4 minutes and then dry; washing after sensitising is unnecessary.

Sensitisers for Collodion Emulsion.

FOR GREEN AND GREENISH YELLOW (Hübl).

Pinaverdol (1: 500)	1 oz.	40 c.c.s.
Collodion emulsion	25 ozs.	1000 ,,

The sensitiveness extends from the orange to the violet.

PANCHROMATIC SENSITISERS (Hübl).

Pinaverdol (1: 500)	3 oz.	30 c.c.s.
Ethyl violet (1: 500)	½ ,,	5 ,,
Collodion emulsion	100 ozs.	1000 ,,

FOR BLUE AND (SLIGHTLY) BLUE-GREEN SENSITIVENESS.

The following sensitiser increases the sensitiveness of the collodion for ordinary work :—

Canary II. (sat. sol.) (Reade Holliday, Huddersfield) ...	1 oz.	10 c.c.s.
Emulsion...	10 ozs.	100 ,,

The dyed emulsion keeps well, and in half-tone work gives a sharp clean dot.

Safe-lights for Developing.

(Newton & Bull.)

Yellow safe light for wet plates, bromide papers.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	$\frac{1}{10}$
Or brilliant yellow	·5 ,,	$\frac{1}{20}$
Naphthol yellow	1 ,,	$\frac{1}{10}$
Auramine	2 ,,	$\frac{1}{5}$

Red safelight for ordinary plates.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	$\frac{1}{10}$
Rose bengal (or fast red) ...	·5 ,,	$\frac{1}{20}$

Safe-light for Ortho plates.

The above screen is combined with one containing—

Methyl violet	·5 mgm.	$\frac{1}{20}$

The red screen transmits light from the end of the visible red about λ 7,000 to λ5,900 in the yellow. The methyl violet absorbs from λ 6,500 to λ 5,000, so that the only light passing the two is the extreme red of λ 7,000 to λ 6,500, to which even the best panchromatic plates are feebly sensitive.

The dyes are dissolved in gelatine solution which in winter should be about 8 per cent. in strength and about 10 per cent. in summer. About 20 c c.s. should be allowed for every 100 sq. cm. of glass, *i.e.*, about 20 minims per sq. in. The dyes are added, most conveniently from stock solutions, in quantity to give the proportions stated above in the filters.

WET COLLODION AND COLLODION EMULSION.

WET COLLODION (for Negatives).

PYROXYLINE (Hardwich).

Sulphuric acid, 1·845 ...	18 ozs. (fl.)	600 c.c.s.
Nitric acid, 1·457	6 ,, ,,	200 ,,
Water	5–5½ ,, ,,	167–182 ,,
Cotton-wool	300 grs.	23 gms.

Temperature 150 degrees F. (65 degrees C.). Time of immersion 10 minutes.

Iodised Collodion.

For Acid Pyro Developer.

Ether, s.g. ·725	10 ozs. (fl.)	1000 c.c.s.
Alcohol, s.g. ·805	4 ,, ,,	400 ,,
Pyroxyline	120 grs.	27 gms.
Iodide of ammonium	30 ,,	7 ,,
,, cadmium	45 ,,	10 ,,
Alcohol (·830)	4 ozs. (fl.)	400 c.c.s.

Bromo-iodised Collodion.

Iron Developer.

Ether, s.g. ·725	10 ozs. (fl.)	1000 c.c.s.
Alcohol, s.g ·805	5 ,, ,,	500 ,,
Pyroxyline	120 grs.	27 gms.
Iodide of ammonium	40 ,,	9 ,,
,, cadmium	40 ,,	9 ,,
Bromide of ,, ...	20 ,,	4·5 ,,
Alcohol (·830)	5 ozs. (fl.)	500 c.c.s.

The Nitrate Bath.

Nitrate of silver (recrystallised)	6 ozs.	75 gms.
Distilled water	80 ,, (fl.)	1000 c.c.s.
Nitric acid (pure)	8 minims	0·2 ,,

Saturate with iodide of silver, which may be done by coating a plate with collodion and leaving it in the bath for some hours. Filter

Developer.

No. 1.	Ferrous sulphate	½ oz.	50 gms.
	Glacial acetic acid	½ ,,	50 c.c.s.
	Alcohol	½ ,,	50 ,,
	Water	10 ozs.	1000 ,,
No. 2.	Ammonio-sulphate of iron ...	75 grs.	43 gms.
	Glacial acetic acid	75 ,,	43 ,,
	Sulphate of copper	7 ,,	4 ,,
	Water	4 ozs.	1000 c.c.s.
	Alcohol	¼ oz.	60 ,,

POSITIVES AND FERROTYPES BY WET COLLODION.

Bromo-iodised Collodion.

Ether, s.g. ·725	10 ozs. (fl.)	1000 c.c.s.
Alcohol, s.g. ·805	5 ,, ,,	500 ,,
Pyroxyline	100 grs.	23 gms.
Iodide of cadmium	50 ,,	11½ ,,
Bromide of ammonium ...	25 ,,	5·7 ,,
Alcohol, ·830	5 ozs. (fl.)	500 c.c.s.

Note.—The iodides should be dissolved in the weaker spirit and the pyroxyline in the ether and stronger spirit, and the two solutions mixed

Silver Bath.

Nitrate of silver (re-crystallised)	5½ ozs.	70 gms.
Distilled water	80 ,, (fl.)	1000 c.c.s.
Nitric acid (pure)	½ drachm	0·8 c.c.

Saturate with iodide of silver and filter as above.

Developers.

Ferrous sulphate	150 grs.	34 gms.
Glacial acetic acid	½ oz.	50 c.c.s.
Nitric acid	5 minims	1 c.c.
Alcohol	½ oz.	50 c.c.s.
Water	10 ozs.	1000 ,,

Note.—By increasing the proportion of nitric acid and decreasing that of the acetic, the image will be more metallic in appearance.

Nitrate of Iron Developer.

Ferrous sulphate	1½ oz.	75 gms.
Nitrate of baryta	1 ,,	50 ,,
Water	20 ozs.	1000 c.c.s.
Alcohol	1 oz.	50 ,,
Nitric acid	40 drops	4 ,,

The insoluble sulphate of baryta which is formed must be filtered out.

Fixing Solution.

Cyanide of potassium... ...	½ oz.	25-30 gms.
Water	15–20 ozs.	1000 c.c.s.

Developer for Collodion Transfers.

Pyrogallic acid	4 gms.	11 gms.
Citric acid	3 ,,	7 ,,
Acetic acid	20 minims	41 c.c.s.
Water	1 oz.	1000 ,,
Alcohol	20 minims	41 ,,

WET COLLODION FOR HALF-TONE.

Eder's Formulæ.

Cadmium iodide	108 grs.	7 gms.
Ammonium iodide	50 ,,	3·2 ,,
Ammonium bromide	18½ ,,	1·2 g.m.
Alcohol	6 ozs.	170 c.c.s.
Raw collodion 2%	18 ,,	511 ,,

Or equal parts of above and—

Strontium iodide	154 grs.	10 gms.
Cadmium bromide	68 ,,	1·8 g.m.
Alcohol	7 ozs.	200 c.c.s.
Collodion 2%	21 ,,	600 ,,

The developer specially recommended for above is—

Sulphate of iron	288 grs.	30 gms.
Sulphate of copper	192 ,,	16 ,,
Glacial acetic acid	1 oz.	50 c.c.s.
Alcohol	½ ,,	30 ,,
Water	20 ozs.	1000 ,,

COLLODION EMULSION.

Pyroxyline for Collodio-bromide or Unwashed Emulsion.

Nitric acid, s.g. 1·45	2 ozs. (fl.)	285 c.c.s.
Sulphuric acid, s.g. 1·845 ...	4 ,,	570 ,,
Water	1 oz. (fl.)	145 ,,
Cotton (cleaned and carded)...	100 grs.	33 gms.

Temperature, 150 degrees F. (65 degrees C.). Time of immersion minutes.

For Washed Emulsion.

Nitric acid, s.g. 1·45	2 ozs. (fl.)	400 c.c.s.
Sulphuric acid, s.g. 1·845 ...	3 ,,	600 ,,
White blotting-paper	145 grs.	66 gms.

Temperature, 100 degrees F. (38 degrees C.). Time of immersion 30 minutes.

Collodio-bromide Emulsion.

Ether, s.g. ·720	5 ozs. (fl.)	620 c.c.s.
Alcohol, s.g. ·820	3 ,,	380 ,,
Pyroxyline	50 grs.	14·3 gms.
Bromide of cadmium and ammonium	80 ,,	23 ,,
or		
Bromide of zinc...	76 ,,	21·5 ,,

Sensitise by adding to each ounce 15 grs. of nitrate of silver dissolved in a few drops of water and 1 drachm of boiling alcohol. This is suitable for slow landscape work or for transparencies.

For Washed Emulsion (for Transparencies).

Ether, s.g. ·720	5 ozs. (fl.)	620 c.c.s.
Alcohol, s.g. ·820	3 ,,	380 ,,
Pyroxyline or papyroxyline...	60 grs.	17 gms.
Bromide of cadmium and ammonium	100 ,,	29 ,,
or		
Bromide of zinc...	96 ,,	27·5 ,,
Hydrochloric acid (s.g. 1·2) ...	8 minims	2 c.c.s.

Sensitise with 20 grs. of nitrate of silver to each ounce (4·3 grs. to each 100 c.c.s.), dissolved in a minimum of water with 2 drachms (13 c.c.s.) of boiling alcohol. Allow to stand for two or three days.

N.B.—In the last formula the emulsion, after being allowed to ripen for the time stated, should be poured into a dish and allowed to

become thoroughly dry. The mass of dry emulsion is then washed to remove all the soluble salts, and is then again dried and redissolved in equal parts of ether and alcohol, at the rate of from 20 to 24 grs. to the ounce of solvents.

WELLINGTON'S COLLODIO-BROMIDE EMULSION FORMULA.

Pyroxyline	30 grs.	23 gms.
Ether	12 drachms	500 c.c.s.
Alcohol	12 ,,	500 ,,

To bromise, add 30 grs. (33 gms.) bromide ammonium dissolved in 45 minims (31 c.c.s.) water, to which 4 drachms (170 c.c.s.) of alcohol are afterwards added; 50 grs. (33 gms.) of nitrate of silver dissolved in a drachm (4½ c.c.s.) of water are then added. After washing and drying, the pellicle is dissolved in 1¾ oz. (58 c.c.s) of ether and the same of alcohol.

DEVELOPER.

An excellent developer for collodion emulsion is the following, worked out by the Bolt Court School of Photo-Engraving, London :—

Glycin	1 oz.	10 gms.
Sodium sulphite	2½ ozs.	25 ,,
Potass carbonate	5 ,,	50 ,,
Potass bromide	30 grs.	·7 gm.
Water to	30 ozs.	300 c.c.s.

INTENSIFYING SOLUTION FOR COLLODION EMULSION.

Nitrate of silver	60 grs.	70 gms.
Citric acid	30 ,,	35 ,,
Nitric acid	30 minims	35 c.c.s.
Water	2 ozs.	1000 ,,

To each drachm of a three-grain solution of pyrogallic acid add 2 or 3 minims of the above, and apply until sufficient density is attained.

PLAIN AND ALBUMEN PAPERS.

PLAIN PAPER.

Prepare the plain paper with—

Ammonium chloride ...	60–80 grs.	14–18 gms.
Sodium citrate	... 100 ,,	23 ,,
Sodium chloride ...	20–30 ,,	4·5–7 ,,
Gelatine	... 10 ,,	2 ,,
Distilled water	... 10 ozs.	1000 c.c.s.

or—

Ammonium chloride ...	... 100 grs.	23 gms.
Gelatine	... 10 ,,	2 ,,
Water	... 10 ozs.	1000 c.c.s.

The gelatine is first swelled in cold water and then dissolved in hot water, and the remaining components of the formula are added. The solution is filtered, and, when still warm, the paper floated upon it for three minutes.

The salted paper is sensitised upon a neutral 45-grain silver bath.

Platinum Toning Bath.

Chloroplatinite of potassium	4·5 grs.	1 gm.
Water	10 ozs.	1000 c.c.s.
Nitric acid	2–3 drops	5–10 drops

ALBUMEN PAPER.

Silver Bath.

Silver nitrate	600 grs.	140 gms.
Distilled water	10 ozs.	1000 c.c.s.

The bath is made just acid with nitric acid, requiring three or four drops per 10 ozs.

Toning Baths.

No. 1.	Chloride of gold	1 gr.	0·3 gm.
	Acetate of soda	30 grs.	6 gms.
	Water	8 ozs.	1000 c.c.s.

This must not be used till one day after preparation. It keeps well and gives warm, rich tones.

No. 2.	Gold chloride	15 grs.	1 gm.
	Water	4 ozs.	120 c.c.s.

Add lime water until a piece of red litmus paper, placed in the solution, is turned blue. Then add—

Calcium chloride, fused ...	120 grs.	7·7 gms.
Water to make...	7½ ozs.	115 c.c.s.

This solution is diluted with 15 times its volume of water to make the toning bath ; it can be used over and over again by addition of stock solution.

To Prevent Blisters in Albumen Prints.

Before wetting the prints immerse them in methylated spirit, then wash and tone as usual.

Preservative for Sensitised Albumen Paper.

Sensitise the paper in the usual bath, drain well, and when superficially dry float the back of the paper for twenty minutes on a solution of—

Citric acid	1 oz.	33 gms.
Water	30 ozs.	1000 c.c.s.

GELATINE P.O.P.

FORMULÆ FOR PRINTING OUT EMULSIONS.

Barker's.

Gelatine (Nelson's No. 1 and Coignet's, equal parts)	175 grs.	80 gms.
Ammonium chloride	18 ,,	8 ,,
Rochelle salts	50 ,,	23 ,,
Silver nitrate	75 ,,	34 ,,
Alcohol	4 drachms	160 c.c.s.
Water	5 ozs.	1000 ,,

Heat to 100 degrees F. (38 degrees C.), and allow to remain at this temperature after all is dissolved for ten minutes, after which proceed in the usual way.

Valenta's.

A.	Silver nitrate	480 grs.	32 gms.
	Citric acid	120 ,,	8 ,,
	Hot water	5¼ ozs.	160 c.c.s.
B.	Gelatine	1440 grs.	96 gms.
	Ammonium chloride	42 ,,	2·8 ,,
	Water	24·3 ozs.	700 ,,
C.	Tartaric acid	42 grs.	2·8 ,,
	Sodium bicarbonate	21 ,,	1·4 gm.
	Alum	27 ,,	1·8 ,,
	Water	5 ozs.	140 c.c.s.

Allow the gelatine to swell in the water and melt by the aid of heat, and add the chloride. Mix B and C at 50 degrees C., and in yellow light add A, heated to the same temperature, in small quantities, shaking thoroughly, and allow the emulsion to ripen for a short time at from 40 degrees to 50 degrees C. and then filter. For matt surface papers the gelatine should be reduced to 754 grs. or 80 gms.

The above formula gives vigorous brilliant prints, but for soft negatives a harder printing emulsion is obtained by adding from 0·05 to 0·1 per cent. of calcium bichromate solution; this can be made by dissolving 480 grs. or 25 gms. of pure chromic acid in 4 ozs. or 100 c.c.s. of distilled water, and adding sufficient pure chalk (calcium carbonate) to make the solution cloudy. The solution should then be filtered, and the filter washed with distilled water up to 4 ozs. or 100 c.c.s.

Beadle's.

Nelson's gelatine	340 grs.	112 gms.
Alum	15·5 ,,	5 gms.
Water	6¼ ozs.	900 c.c.s.
Rochelle salt	15·5 grs.	3·5 gms.
Ammonium chloride	11 ,,	5 ,,
Heat to 50 degrees C., and add—		
Silver nitrate	115 grs.	37·5 gms.
Citric acid	62 ,,	20 ,,
Water	1 oz.	100 c.c.s.

GOLD TONING BATHS.

Sulphocyanide.

Gold chloride	2½ grs.	·3 gm.
Ammonium sulphocyanide ...	30 ,,	3·5 gms.
Water	20 ozs.	1000 c.c.s.

It is necessary for this and all sulphocyanide baths to ripen. The best method of mixing is to boil the water and to dissolve the gold in one half and the sulphocyanide in the other. Then pour the former into the latter, stirring all the time, and use when cool. If cold water is used, the mixture should be allowed to stand 12 hours.

Formate.

Gold chloride	1 gr.	·12 gm.
Sodium bicarbonate	2 grs.	·23 ,,
Sodium formate	8 ,,	·9 ,,
Water	20 ozs.	1000 c.c.s.

The prints must be immersed in a 10 % solution of salt and water before using this bath.

Tungstate.

Sodium tungstate	30 grs.	3·5 gms.
Sodium carbonate	1 gr.	·12 gm.
Gold chloride	1 ,,	·12 ,,
Water	...10-20 oz.	500-1000 c.c.s.

Concentrated Sulphocyanide.
(Bühler's Formula.)

A.	Distilled water	1 oz.	150 c.c.s.
	Gold chloride	15 grs.	5 gms.
B	Strontium chloride	150 ,,	50 ,,
	Distilled water	¾ oz.	100 c.c.s.
C.	Potassium sulphocyanide	80–150 grs.	25–50 gms.
	Distilled water	1¾ oz.	250 c.c.s.

Heat B to boiling, and add A (heated to 100 degrees F.) in small doses. Bring C to boiling, and allow to cool to 205 degrees F., and add the hot mixture of A and B in four or five lots with constant stirring; cool and filter. If a precipitate forms, re-heat to nearly boiling, wash the filter with ¾ oz. (100 c.c.s.) water, and add this latter to the total bulk. The bath is diluted with 10 times its volume of water for use.

Thiocarbamide Bath.

Gold chloride	4 grs.	·25 gm.
Distilled water	1 oz.	25 c.c.s.

Add, to dissolve precipitate first formed, sufficient of :—

Thiocarbamide	90 grs.	1 gm.
Distilled water	10 ozs.	50 c.c.s.

About ½ oz. (14 to 15 c.c.s.) will be needed. Next add :—

Citric acid	8 grs.	·5 gm.

and

Distilled water to	35 ozs.	1000 c.c.s.

and finally

Salt	160 grs.	10 gms.

The prints should be thoroughly washed *before* as well as after fixing.

Short Stop for Gold Toning.

A weak solution of sodium sulphite (5 grs. per oz.) at once arrests the action of a gold toning bath.

SALT BATH.

A short immersion of prints in the following bath prior to the first washing favours even toning and prevents spots and stains from rusty tap water :—

Salt	2 ozs.	100 gms.
Sodium carbonate	1 oz.	50 ,,
Water	20 ozs.	1000 c.c.s.

If prints are to be toned in the platinum bath, the carbonate should be omitted.

PLATINUM TONING BATHS.

Phosphoric Acid.

Potass chloroplatinite... ..	4 grs.	·45 gm.
Phosphoric acid (sp. gr. 1.12) ..	¾ oz. (fl.)	35 c.c.s.
Water to...	20 ozs.	1000 ,,

Citric Acid.

Potass chloroplatinite... ...	4 grs.	·45 gm.
Sodium chloride (salt)	40 ,,	4·5 gms.
Citric acid	50 ,,	5·8 ,,
Water to	20 oz.	1000 c.c.s.

Haddon's Formula.

Platinum perchloride	3 grs.	·2 gm.
Sodium formate	100 ,,	6·5 gms.
Formic acid	30 minims	1·8 c.c.
Water to...	35 oz.	1000 c.c.s.

Short Stop for Platinum Toning.

A weak solution of sodium carbonate (10 grs. per oz.) instantly arrests the toning action of a platinum bath.

Black Tones.

Valenta's Formula.

Tone in—

Potass chloroplatinite... ...	2½- 0 grs.	·5-2 gm.
Metaphenylenediamine ..	2½-10 ,,	·5-2 ,,
Water	10 ozs.	1000 c.c.s.

having first washed the prints well.

Another method is to print deeply and immerse the prints in :—

Salt	1 oz.	25 gms.
Sodium bicarbonate	80 grs.	9 ,,
Water	20 ozs.	1000 c.c.s.

then wash well and tone in a borax gold bath to a purple red. Again well wash and tone in the phosphoric platinum bath.

VALENTA'S BATH FOR RED TONES.

Uranium nitrate	10–20 grs.	1–2 gms.
Thiosinamine	90 ,,	10 ,,
Water	20 ozs.	1000 c.c.s.

The prints are well washed, finally in water acidulated with acetic acid, and then toned. They are afterwards fixed, or can be toned to sepia brown in the combined bath.

COMBINED BATHS.

Valenta's.

Hypo	8 ozs.	400 gms.
Ammonium sulphocyanide ...	1 oz.	50 ,,
Lead nitrate	175 grs.	20 ,,
Alum	350 ,,	40 ,,
Water to...	20 ozs.	1000 c.c.s.

Dissolve the hypo in the water, add the sulphocyanide, then add the alum dissolved in a little water, and also the lead, and add to the hypo. Heat the mixture to 120 degrees F. for ten minutes; allow to cool. For use take

Stock solution (as above) ...	10 oz.	100 c.c.s.
Water	10 ,,	100 ,,
Gold chloride (from stock sol.)	3½ grs.	·23 gm.

Alkaline Toning and Fixing Bath.

Gold chloride	2 grs.	·23 gm.
Lead nitrate	10 ,,	1·2 ,,
Chalk	½ oz.	25 gms.
Hypo	4 ozs.	200 ,,
Water	20 ,,	1000 ,,

Shake the solution well, allow to settle and use the clear portion.

REDUCER FOR OVER-PRINTED PROOFS.

A. Ammonium sulphocyanide ... ... 10% sol.
B. Potass ferricyanide ... ... 10% sol.

A, 5 ozs.; B, ½ oz.; water, 24 ozs.

DEVELOPING P.O.P.

Direct Process with Acid Developer.

Hydroquinone	16 grs.	18·5 gms.
Citric acid	40 ,,	4·6 ,,
Sodium acetate	1 oz.	50 ,,
Water	20 ozs.	1000 c.c.s.

Immerse the dry prints in the developer, and after development wash in plenty of water for 10 or 15 minutes, then tone in the usual way.

PAGET "BROMIDE" PROCESS.

The prints are immersed in 10 per cent. potass bromide solution for 5 or 10 minutes, washed and developed with the following :—

A. Hydroquinone	40 grs.	4·5 gms.	
Sodium sulphite	160 ,,	18·0 ,,	
Water to	20 ozs.	1000 c.c.s.	
B. Potass bromide...	2½ ,,	12·5 gms.	
Sodium carbonate	2 ,,	10·0 ,,	
Water to...	20 ,,	1000 c.c.s.	

For average negatives mix :—A, ½ oz. ; B, 1 oz. ; water, ½ oz.

For flat negatives (greater contrast), A, 3 drachms ; B, 1 oz. ; water, 5 drachms.

For hard negatives (soft results), say, A, 7 drachms ; B, 1 oz. ; water, 1 drachm.

BRUSH TONING.

Very rapid toning can be done with a strong toning bath applied with a brush, and though the method consumes more gold than the usual one, there are times when it is conveniently adopted. Toning takes place in about two minutes, and the process yields good rich tones.

Toning Solution.

Ammonium sulphocyanide 10% sol.	70 minims	4 c.c.s.
Water to make	5 drachms	18 ,,

Add little by little in order given—

Gold chloride sol. (1 gr. per drachm)	1 drachm	3·5 c.c.s.
Sodium phosphate (10% sol.)	30 minims	1·8 c.c.
Borax saturated solution ...	80 ,,	45 c.c.s.

From 30 to 45 minims are used per quarter-plate print.

COLLODIO-CHLORIDE P.O.P.

VALENTA'S FORMULA.

1. Strontium chloride ...	154 grs.	10 gms.	
Lithium chloride	77 ,,	5 ,,	
Water	500 minims	30 c.c.s.	
Alcohol (absolute)	930 ,,	55 ,,	
2 Silver nitrate	400 grs.	20 gms.	
Water	500 minims	30 c.c.s.	
Alcohol	1000 ,,	60 ,,	
3. Citric acid	77 grs.	5 gms.	
Alcohol	675 minims	40 c.c.s.	
Glycerine	92 grs.	6 gms.	

In a bottle capable of holding 1000 parts pour 350 parts of 3 per ent. collodion and add gradually 15 parts of No. 1, then in the dark room add almost drop by drop 60 parts of No. 2, shaking well after

each addition ; then add 50 parts of No. 3, and 50 parts of ether. This collodion is suitable for normal negatives, but more contrast can be obtained if 0·1 to 0·4 per cent. calcium chromate solution is added. By reducing the amount of pyroxyline in the above formula the emulsion is more suitable for matt surface paper.

GOLD-PLATINUM TONING.

GOLD BATH.

Gold chloride	½ gr.	·06 gm.
Sodium acetate	20 grs.	4·6 gms.
Water to	20 ozs.	1000 c.c.s.

PLATINUM BATH.

Potass chloroplatinite	½ gr.	·06 gm.
Phosphoric acid...	2¼ ozs.	110 c.c.s.
Water to...	20 ,,	1000 ,,

For black tones, the prints are first toned in the gold bath (for a longer or shorter time according as a more or less black tone is desired), washed in three changes of water and completed in the platinum bath.

BROMIDE AND GASLIGHT PAPERS.

Developers.

AMIDOL.

Sodium sulphite	650 grs.	74 gms.
Potassium bromide	10 ,,	1·2 gm.
Water	20 ozs.	1000 c.c.s.

When dissolved add—

Amidol	50 grs.	5·7 gms.

This developer will not keep more than three days.
See also the formula given under "Negative Developers."

The most convenient and economical method of using amidol developer for bromide papers is to make up a 10 per cent. stock solution of sodium sulphite and add 5 grs. potassium bromide to each 10 ozs. solution. For use add 4 grains dry amidol to each ounce stock solution, and dilute with an equal bulk of water.

METOL.

[A. Metol	100 grs.	11·5 gms.
Sodium sulphite	2 ozs.	100 ,,
Potassium bromide	12 grs.	1·4 gm.
Water	20 ozs.	1000 c.c.s.
B. Potassium carbonate	2 ,,	100 gms.
Water	20 ,,	1000 c.c.s.

For use take 3 ozs. of A and 1 oz. of B.
For gaslight papers use half the quantity of water in above formula.

METOL HYDROQUINONE.

Metol	8 grs.	1 gm.
Hydroquinone	30 ,,	3·5 gms.
Sodium sulphite	¾ oz.	37·5 ,,
Sodium carbonate	¾ ,,	37·5 ,,
10% solution of potassium bromide	20 minims	2·5 c.c.s
Water	20 ozs.	1000 ,,

For gaslight papers make up above formula with 10 ozs. of water

RODINAL.

Rodinal	100—150 minims	6—9 c.c.s.
Water	10 ozs.	300 ,,
10% solution of potassium bromide	20 minims	1 c.c.

ORTOL.

A. Ortol	120 grs.	14	gms.
Potassium metabisulphite ...	60 ,,	7	,,
Water	20 ozs.	1000	c.c.s.
B. Sodium sulphite	4 ,,	200	gms.
Potassium carbonate	1 oz.	100	,,
Potassium bromide	20 grs.	2·3	,,
Water	20 ozs.	1000	c.c.s.

Use equal parts of A and B.

For gaslight papers use half the quantity of water given in this formula.

FERROUS OXALATE.

A. Sulphate of iron	5 ozs.	250	gms.
Sulphuric acid	30 minims	3	c.c.s.
Warm water to...	20 ozs.	1000	c.c.s.
B. Neutral oxalate of potassium	5 ozs.	250	gms.
Potassium bromide	10 grs.	1·2	gm.
Warm water to	20 ozs.	1000	c.c.s.

For use add 1 oz. of A to 4 ozs. of B, not *vice versa*.

After development and without washing, immerse the prints for two minutes in acid bath, pour off and repeat.

Acid Bath.

Glacial acetic acid	1 drachm	6 c.c.s.
Water	20 ozs.	1000 ,,

Then wash thoroughly to remove last trace of acid.

Toning Bromide and Gaslight Prints.

SEPIA AND BROWN TONES.

HYPO-ALUM.

Hot water	20 ozs.	1000 c.c.s.
Hypo	2½ ,,	125 gms.

Dissolve and add—

Alum	½ oz.	25 ,,

This solution should not be filtered and it works better as it becomes older; it may be strengthened from time to time with a little fresh solution.

The best results are obtained by keeping the bath hot, or as warm as the emulsion will stand, say 100 to 120 degrees F. In this bath prints will tone in 30 to 40 minutes. When this toning bath is to be employed, the use of the alum bath after fixing is absolutely essential. Moreover, the prints should not, in this case, be subjected to a prolonged washing, but should only be slightly rinsed before being dried.

A new bath tends to reduce the prints rather more than an old one.

When toned the prints should be placed in a tepid solution of—

Water	70 ozs.	1000 c.c.s.
Alum	2 ,,	30 gms.

and then washed thoroughly.

SULPHIDE TONING.

A. Ammonium bromide ...	... 300 grs.	35 gms.
Potassium ferricyanide	... 300 ,,	35 ,,
Water	... 20 ozs.	1000 c.c.s.
B. Sodium sulphide (pure)	... 100 grs.	12 gms.
Water	... 20 ozs.	1000 c.c.s.

Bleach the fixed and washed print in A solution. Wash for a few minutes in water and then immerse in B solution until toned. The print is then well washed and dried.

COPPER TONING.

A. Copper sulphate ...	... 60 grs.	7 gms.
Potassium citrate (neutral)	... 240 ,,	28 ,,
Water	... 20 ozs.	1000 c.c.s.
B. Potassium ferricyanide	... 50 grs.	6 gms.
Potassium citrate (neutral)	... 240 ,,	28 ,,
Water	... 20 ozs.	1000 c.c.s.

Use equal parts of each. Warm black to red chalk tones are obtained.

PLATINUM TONING.

(Not for Gaslight Prints.)

Potassium chloroplatinite ...	12 grs.	·8 gm.
Mercuric chloride	6 ,,	·4 ,,
Citric acid	54 ,,	3·4 gms.
Water	6 ozs.	170 c.c.s.

This bath should be made up fresh for use from stock solutions. Gives warm sepia tones, with slight staining of high lights. For cold sepia tones and absence of staining add 30 minims 10 per cent. solution potassium bromide to above. Wash well after toning.

Uranium Toning.

A.	Uranium nitrate	90 grs.	10 gms.
	Water	20 ozs.	1000 c.c.s.
B.	Potassium ferricyanide ...	90 grs.	10 gms.
	Water	20 ozs.	1000 c.c.s.

Use equal parts of A and B, and add 20 minims of glacial acetic acid to each ounce of mixture. The prints must be free from hypo. After toning wash in several changes of *still* water till the high-lights are clear. Washing in running water will remove the toning in patches. This bath intensifies the image.

Green Tones.

Vanadium chloride	20 grs.	1 gm.
Ferric chloride	10 ,,	·5 ,,
Ferric oxalate	10 ,,	·5 ,,
Potassium ferricyanide ...	20 ,,	1 ,,
Oxalic acid (sat. sol.) ...	2½ ozs.	60 c.c.s.
Water to...	20 ,,	1000 ,,

Dissolve the vanadium salt in hot hydrochloric acid and a little water. Add the ferric chloride and oxalate to the oxalic acid solution diluted with half the water, then add the ferricyanide dissolved in water, stirring well, and finally the vanadium. Tone till the prints turn blue, and then wash till they are green.

Blue Tones.

10% solution ferric ammonium citrate	2 ozs.	10 c.c.s.
10% solution potassium ferricyanide	2 ,,	10 ,,
10% solution acetic acid ...	20 ,,	100 ,,

The well washed prints are immersed in this bath until the desired tone is given. Then well wash until high lights are clear. This bath intensifies the image.

Gold Toning.

Ammonium sulphocyanide ...	30 grs.	2	gms.
Chloride of gold	2 ,,	·13	gm.
Boiling water	4 ozs.	110	c.c.s.

Use as soon as cool. Place the wet print face upwards on a sheet of glass, squeegee into contact, blot off superfluous moisture, and paint the above bath on with a broad flat brush; when the desired tone is reached wash well and dry. This considerably improves the colour of greenish or rusty black prints, and if allowed to act for some time bluish tones are obtained.

Practically all the above toning solutions can be employed for lantern plates.

Making Line Drawings from Bromide, Gaslight, or P.O.P. Prints.

After outlining the subject in waterproof Indian ink, bleach out the image in—

Thiocarbamide	240 grs.	25 gms.
Nitric acid	4 drachms (fl.)	25 c.c.s.
Water	20 ozs.	1000 ,,

Or in—

Iodine sol. (10% in potass iodide sol.)	30 minims	6 c.c.s.
Potass cyanide (10% sol. in water)	5 ,,	1 c.c.
Water	1 oz.	100 c.c.s.

The iodine-cyanide solution, weaker if necessary, can be used as a reducer for over-developed bromide or gaslight prints.

THE CARBON PROCESS.

SENSITISING SOLUTIONS.

Potass bichromate	1 oz.	35–50 gms.
Water	20–30 ozs.	1000 c.c.s.
Liquor ammonia (·880) ...	60 minims	6 ,,

A longer immersion in the weaker solution is practically equal to a shorter one in the stronger bath.

If the tissue is squeegeed on a glass plate after sensitising light or heavy squeegeeing also modifies its sensitiveness by removing more or less of the solution. If the tissue be squeegeed on to a ferrotype plate, and allowed to dry upon it, the drying may be done in the light of an ordinary room. The face of the tissue is then protected from light, dust, and injurious vapours.

The following has been recommended :—

B.	Potass bichromate	1 oz.	20 gms.
	Water	50 ozs.	1000 c.c.s.
	Citric acid	¼ oz.	5 gms.

Liquor ammonia q.s. to change the tint of the solution to a lemon yellow. This gives a slower tissue than the above, but is said to keep better.

WAXING SOLUTIONS.

For Carbon Prints, or for Removing Collodion Films.

No. 1.	Beeswax	20 grs.	10 gms.
	Benzole rect. No. 1	4 ozs.	1000 c.c.s.

For Flexible Supports (Autotype.)

No. 2.	Yellow resin	180 grs.	42 gms.
	Yellow beeswax...	60 ,,	14 ,,
	Rectified spirits of turpentine	10 ozs.	1000 c.c.s.

Fixing or Hardening Bath.

Alum	1 oz.	50 gms.
Water (1 pint)	20 ozs.	1000 c.c.s.

GELATINE SOLUTIONS.

For transferring carbon pictures from flexible support to ivory opal, glass, etc. :—

Nelson's No. 1 gelatine ...	1 oz.	50 gms.
Water	1 pint	1000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c.c.s.) hot water..	12 grs.	1·4 gm.

For coating drawing-papers for the single transfer process :—

Nelson's No. 1 gelatine ...	1 oz.	50 gms.
Water	1 pint	1000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c.c.s.) water ...	20 grs.	2·3 gms.

Apply with a brush.

Note.—In adding a solution of chrome alum to one of gelatine, both solutions should be at a fairly high temperature, 130 degrees to 160 degrees F.

Substratum for Carbon Transparencies.

Nelson's No. 1 gelatine ...	¾ oz.	37 gms.
Water	20 ozs.	1000 c.c.s.
Potass bichromate	12 grs.	1·4 gm.

Well cleaned plates are coated with this and dried, when they are fully exposed to light, which will render the coating insoluble.

To remove Bichromate Stains from the Fingers and Nails after Sensitising.

Apply dilute ammonia to the parts until the stains disappear, then well wash the hands with warm water and soap.

PLATINUM PRINTING.

DEVELOPERS FOR SEPIA TONES.

A. Potass oxalate	2 oz.	20 gms.
Water...	15 ozs.	150 c.c.s.
B. Potass citrate	160 grs.	23 gms.
Citric acid	250 ,,	39 ,,
Mercuric chloride	95 ,,	14 ,,
Water	15 ozs.	1000 c.c.s.

Equal parts of A and B, used slightly warm. The prints are afterwards fixed in acid baths of one-third the usual strength.

Another Formula.

Prepare the following solutions :—

1. Potassium oxalate	4 ozs.	250 gms.
Distilled water	16 ,,	1000 c.c.s.
2. Cupric chloride...	124 grs.	35 gms.
Distilled water	8 ozs.	1000 c.c.s.
3. Mercuric chloride	1 oz.	62 gms.
Distilled water	16 ozs.	1000 c.c.s.
4. Lead acetate	32 grs.	18 gms.
Distilled water	4 ozs.	1000 c.c.s.

Mix 12 parts of No. 1 with 4 parts No. 2, then add 4 parts No. 3 and 1 part No. 4, and heat till the precipitate first formed is redissolved. The solution should be heated to 175 degrees F., and the prints developed in it in the usual way and treated to the usual acid clearing baths, then immersed in ammonia solution (about 10 minims per oz.) for five minutes, and washed and dried.

Intensifier for Platinum Prints.

A. Sodium formate	45 grs.	100 gms.
Water	1 oz.	1000 c.c.s
B. Platinum perchloride	10 grs.	1 gm.
Water	1 oz.	45 c.c.s.

Add 15 minims each of A and B to 2 ozs. water (3 c.c.s. to 100 c.c.s.).

Restoring Yellowed Prints.

Shake up bleaching powder with about ten times its weight of water, let the mixture stand a few minutes, and pour off the clear part. To this latter add a little weak hydrochloric acid—enough to give the mixture a faint chlorine smell. The solution removes the yellow (iron) stain from platinum prints.

FERRO-PRUSSIATE, ETC.

Sensitiser for Blue Paper.

A. Ferric ammonium citrate (green)*	110 grs.	250 gms.
Water	1 oz.	1000 c.c.s.
B. Potass ferricyanide	40 grs.	90 gms.
Water	1 oz.	1000 c.c.s.

Mix in equal parts, keep in the dark and filter just before use.

Solution for Writing Titles on, removing blue lines from blue prints, etc.—Potass oxalate, 75 grs. per oz.; 170 gms. per 1000 c.c.s.

SEPIA PAPER.

A. Ferric ammonium citrate (green)	110 grs.	250 gms.
Water	1 oz.	1000 c.c.s.
B. Tartaric acid	18 grs.	40 gms.
Water	1 oz.	1000 c.c.s.
C. Silver nitrate	45 grs.	100 gms.
Water	1 oz.	1000 c.c.s.

*If the ordinary brown citrate is used, the formula should contain 80 grs (183 gms.), and the ferricyanide should be increased to 60 grs. (137 gms.)

D. Gelatine	30 grs.	70 gms.
Water	1 oz.	1000 c.c.s.

Equal parts (say 1 oz. of each) of these solutions are mixed as follows:—D is rendered just fluid on a water bath, A and B added, and lastly C, a few drops at a time. The prints are fixed in 1 : 50 hypo.

PELLET PROCESS.

A. Pure gum arabic	4 ozs.	200 gms.
Water	20 ,,	1000 c.c.s.
B. Ferric ammonium citrate ...	10 ,,	500 gms.
Water	20 ,,	1000 c.c.s.
C. Ferric chloride (crystallised) ..	10 ,,	500 gms.
Water	20 ,,	1000 c.c.s.

Take 8 vols. of B, then 5 vols. of C, to 20 vols. of A, in small doses with constant stirring.

The prints are developed in 10 per cent. solution of potass ferrocyanide and "fixed" in 1 : 25 sulphuric acid.

THE FERRO-GALLIC PROCESS.

Gum arabic	60 grs.	135 gms.
Warm water	1 oz	1000 c.c.s.

When dissolved add the following in the order given—

Tartaric acid	8 grs.	18 gms.
Salt	36 ,,	81 ,,
Ferric sulphate	40 ,,	90 ,,
Ferric chloride	60 ,,	135 ,,

The developer for the prints is :—Alum and gallic acid, 1 part of each ; water, 80 parts.

MOUNTANTS.

GELATINE.

(For mounting prints without cockling.)

Nelson's No. 1 gelatine ...	4 ozs.	50 gms.
Water	16 ,,	200 c.c.s.

Soften the gelatine in the water, liquefy on the water bath, and add a little at a time and stirring rapidly.

Methylated spirit	5 ozs.	30 c.c.s
Glycerine	1 oz.	6 ,,

The mountant is used hot: A piece of ground glass is dipped in hot water, drained, and the mountant brushed over. The print is then laid face up on the pasted surface and rubbed gently in contact with a piece of paper, being then removed and pressed down on its mount.

DEXTRINE PASTE.

Best white dextrine	1 lb.
Cold water	to make stiff paste.
Water	10 ozs.
Oil of wintergreen	1 drachm

Mix the dextrine and water together in small doses of each so as to ensure a mixture free from lumps and clots. Dilute with the further quantity of water, add the oil and just bring the whole mixture to the boil, when it should be like clear gum. Pour into pots, cover up, and in from 12 to 24 hours it will be set to a hard and white paste of great adhesive power. The dextrine must be the best white: inferior dextrine remains treacly on cooling.

STARCH-GELATINE.

A. Bermuda arrowroot	8 ozs.	200 gms.
Water	4 ,,	100 c.c.s.
B. Nelson's No. 1 soft gelatine ...	360 grs.	10 gms.
Water	64 ozs.	800 c.c.s.

The gelatine is first softened in the water and A and B are then mixed together and boiled for a few minutes. To the cold mixture are stirred in—

Methylated spirit	5 ozs.	250 c.c.s.
Carbolic acid (liquid)	25 minims	3 c.c.s.

This is a good cold paste, which sticks and keeps fairly well.

LIQUID GELATINE.

Gelatine	1 oz.	100 gms.
Water	6 ozs.	600 c.c.s.
Chloral hydrate...	1 oz.	100 gms.

The gelatine is dissolved in the water by aid of heat and the chloral hydrate added. After digesting for a short time the adhesive liquid is neutralised with a little sodium carbonate solution.

SHELLAC MOUNTANT.

A strong solution of shellac in methylated spirit, or better, rectified spirit, is thinly applied to both mount and print and the two coated surfaces quickly rubbed into contact. A good method of fixing prints to thin mounts in albums, etc.

AFFIXING PAPER TO METAL.

Tragacanth	3 ozs.	3 gms.
Gum arabic	12 ,,	12 ,,
Water	50 ,,	50 c.c.s.
or—		
Gum arabic	1 oz.	10 gms.
Water	10 ozs.	100 c.c.s.
Aluminium sulphate	45 grs.	1 gm.

SPOTTING, COLOURING, ETC., PRINTS.

LUBRICANT FOR BURNISHING PRINTS.

Castile soap	20 grs.	5 gms.
Alcohol	10 ozs.	1000 c.c.s.

Encaustic Paste.

Pure wax...	5 ozs.	500 gms.
Gum elemi	45 grs.	10 ,,
Benzole	2 ozs.	200 c.c.s
Essence of lavender	3 ,,	300 ,,
Oil of spike	1 drachm	15 ,,

Or, paraffin wax with oil of lavender enough to make a stiff paste

Baskett's Formula.

To the contents of a 2d. tin of Globe polish add 1 oz. best olive oil and 1 oz. terebine. Apply with soft cloth, and polish.

Preparing Prints for Colouring.

(For gelatine prints.)

Oxgall paste	60 grs.	3.5 gms.
Distilled water	16 ozs.	400 c.c.s.
Rectified spirit	4 ,,	100 ,,

This medium is applied with a flat camel-hair brush to the print, which, when dry, is ready for colouring in either oil or water-colours.

(For collodion prints.)

Quillaia bark (powdered) ...	50 grs.	10 gms.
Cold water	1 oz.	100 c.c.s.

Soak for 12 hours with occasional stirring, and add—

Alcohol	1 oz.	100 c.c.s.
Salicylic acid	5 grs.	1 gm.

To prepare bromide prints for working up with crayon or stump apply fine pumice-stone powder with soft pad or palm of hand.

Fixatif for Crayon and Pastel Work.

A. Mastic	24 grs.	1·6 gm.
Amyl acetate	3 ozs.	85 c.c.s.

Dissolve by agitation and allow to stand some hours before use.

B. Celluloid (film clippings free from emulsion will do) ...	7 grs.	·45 gm.
Amyl acetate	3 ozs.	85 c.c.s.

Dissolve by agitation. Mix when both are clear, and keep in tightly corked bottle. Apply with spray diffuser.

Spotting Prints.

For spotting prints to be glazed by stripping from plain or collodionised glass, tubes of artists' oil colours are thinned with benzole and dammar varnish and used as spotting media.

MISCELLANEOUS FORMULÆ.

THE DUSTING-ON PROCESS.

Best gum arabic	80 grs.	5·2 gms.
White sugar	60 ,,	4·0 ,,
Ammonium bichromate ...	60 ,,	4·0 ,,
Water	7 ozs.	200 c.c.s.
Methylated spirit	1 oz.	30 ,,

This mixture will keep for a few days only, and after the plate has been coated and exposed it is developed with finest graphite powder, collodionised, and washed.

To Recover Fogged Plates.

Make a solution as follows :—

Chromic acid	30 grs.	7 gms.
Bromide of potassium... ...	60 ,,	14 ,,
Water	10 ozs.	1000 c.c.s.

And immerse the plates for five minutes. Afterwards wash very thoroughly, and rear up to dry.

Backing Sheets for Dry Plates.

Gelatine	1 part	50 gms.
Water	2 parts	100 c.c.s.
Glycerine	1 part	50 ,,
Indian ink	A small addition.	

Make a paste, and coat strong paper ; place the prepared material, face downwards, on waxed glass to set. Press to back of plate before putting into dark slide.

Backing for Dry Plates to Prevent Halation (Teape's).

Gum solution (ordinary office gum)	1 oz.	100 c.c.s.
Caramel	1 ,,	100 gms.
Burnt sienna, ground in water	2 ozs.	200 ,,

Mix and add—

Alcohol	2 ,, (fl.)	200 c.c.s.

Colour for Applying to Bright Machinery Prior to Photographing it.

Mix white lead with turpentine to the consistence of thin cream with sufficient lamp-black to form a light slate colour, and then add one-sixth the bulk of japanners' gold size. Paint the machinery over with this. After the photograph has been taken, the colour can be quickly removed with a pledget of "cotton waste" moistened with turpentine or benzoline.

White Ink for Lantern Slides' Masks

A mixture is made of water (containing about 40 grains per ounce of gum arabic) and artists' zinc white.

Ink for Rubber Stamps.

Aniline red (violet) ...	... 900 grs.	210 gms.
Boiling distilled water...	... 10 ozs.	1000 c.c.s.
Glycerine	about ½ oz.	60 ,,
Treacle	... about ¼ ,,	30 ,,

Invisible Ink.

Chloride of cobalt ...	... 25 grs.	60 gms.
Distilled water...	... ... 1 oz. (fl.)	1000 c.c.s.

Writing executed with this ink is first pink on paper, becoming invisible on drying. On warming, the writing turns blue.

Dead Black for Wood.

Borax	30 grs.	8 gms.
Glycerine	30 minims	8 c.c.s.
Shellac	60 grs.	16 gms.
Water	8 ozs.	1000 c.c.s.

Boil till dissolved and add—

Nigrosine W.S....	60 grs.	16 gms.

Or paint the wood first with

Cupric chloride	75 grs.	75 gms.
Potassium bichromate... ...	75 ,,	75 ,,
Water	2½ ozs.	1000 c.c.s.

and as soon as the surface dries apply

Aniline hydrochlorate... ...	150 grs.	150 gms.
Water	2½ ozs.	1000 c.c.s.

and wipe off any yellow powder that forms. Repeat the process till black enough, and then rub over with boiled linseed oil.

Waterpoofing Solution for Wood.

Ashphalt...	4 ozs.	400 gms.
Pure rubber	30 grs.	6 ,,
Mineral naphtha	10 ozs.	1000 c.c.s.

Apply with a stiff brush and give three successive coats, allowing to dry between each. The vapour from this solution is very inflammable.

Polish for Cameras, Woodwork, etc.

Linseed oil	20 ozs.	400 c.c.s.
Spirits of camphor	2 ,,	40 ,,
Vinegar	4 ,,	80 ,,
Butter of antimony	1 oz.	20 gms.
Liquid ammonia	¼ ,,	5 c.c.s.
Water	¼ ,,	5 ,,

This mixture is applied very sparingly with a bit of old flannel, and thoroughly rubbed off with soft rags.

Blackening Brass Work.

A. Copper nitrate	200 grs.	450 gms.
Water	1 oz.	1000 c.c.s.
B. Silver nitrate	200 grs.	450 gms.
Water	1 oz.	1000 c.c.s.

Mix A and B, and place the brass-work (perfectly cleaned) in the solution for a few moments, heating it on removal.

Varnish for Brass-Work.

Celluloid	10 grs.	4 gms.
Amyl alcohol	½ oz.	100 c.c.s.
Acetone	½ ,,	100 ,,

Instead of this cold celluloid varnish, commercial "cold lacquer" can be used.

TO BLACKEN ALUMINIUM.

Clean the metal thoroughly with fine emery powder, wash well, and immerse in—

Ferrous sulphate	1 oz.	80 gms.
White arsenic	1 ,,	80 ,,
Hydrochloric acid	12 ozs.	1000 c.c.s.

Dissolve and add—

Water	12 ozs.	1000 c.c.s.

When the colour is deep enough dry off with fine sawdust and lacquer.

SILVERING MIRRORS.

(Lumière's Process.)

The glass to be silvered should be well cleaned with pure nitric acid, then well washed with distilled water and levelled and flooded with a mixture of—

Water	3 ozs.	75 c.c.s.
Rectified spirit	1 oz.	25 ,,

and allowed to remain several minutes, whilst the following solution is prepared—

Formaline 40 %...	10 drops.	10 drops
Rectified spirit	170 minims	10 c.c.s.
Distilled water	170 ,,	10 ,,
Solution of silver nitrate ...	¾ oz.	20 ,,

The solution of silver is prepared as follows :—

Silver nitrate	155 grs.	10 gms.
Distilled water	3½ ozs.	100 c.c.s.

When dissolved add strong ammonia ·880 drop by drop, with constant stirring, till the precipitate first formed is just re-dissolved. Excess of ammonia should be avoided. Then add—

Siver nitrate	30 grs.	2 gms.
Distilled water	3½ ozs.	100 c.c.s.

and make the total bulk 35 ozs. or 1000 c.c.s., and filter two or three times till absolutely bright and clear. Drain the plate after the alcohol bath and pour the silvering solution over it and gently rock. Deposition begins in from 90 to 120 seconds, and the action should be allowed to continue till the solution turns thick, at which stage pour the solution off and flood with fresh. This operation may be repeated three or four times if necessary, or until a sufficiently thick film is obtained, then rinse and dry. Polish with a chamois leather dusted with "gold rouge." The spirit tends to prevent the formation of too rapid a deposit, and the necessary amount of formaline should be found by preliminary test. The above quantity is sufficient for a sheet of glass 24 × 18 cms., and the temperature should be from 16 to 20 degrees C. Practically 170 minims are sufficient for 16 sq. in.

SILVERING MIRRORS (MARTIN'S METHOD).

(*In employing the following formulæ, it should be well understood that the glass plate to be silvered must be scrupulously clean.*)

A. Nitrate of silver	175 grs.	40 gms.
Distilled water	10 ozs.	1000 c.c.s.
B. Nitrate of ammonium... ...	262 grs.	60 gms.
Distilled water	10 ozs.	1000 c.c.s.
C. *Pure* caustic potash	1 oz.	100 gms.
Distilled water	10 ozs.	1000 c.c.s.
D. Pure sugar candy	½ oz. (avoir.)	100 gms.
Distilled water	5 ozs.	1000 c.c.s.

Dissolve and add—

Tartaric acid	50 grs.	23 gms.

Boil in flask for 10 minutes, and when cool add—

Alcohol	1 oz.	200 c.c.s.

Distilled water *quant. suff.* to make up to 10 ozs. or 2000 c.c.s.

For use, take equal parts of A and B. Mix together also equal parts of C and D, and mix in another measure. Then mix both these mixtures together in the silvering vessel, and suspend the mirror face downward in the solution.

DEVELOPING FORMULÆ, ETC., OF THE PRINCIPAL PLATE AND PAPER MAKERS.

AUSTIN EDWARD'S FORMULÆ.

Developers for Cut and Roll Films.

Pyro.

Stock Solution.

	Pyrogallic acid	1 oz.	12·5 gms.
	Nitric acid	20 drops	0·5 c.c.
	Water	8 ozs.	1000 c.c s.
No. 1.	Stock solution	2 ,,	100 ,,
	Water	20 ,,	1000 ,,
No, 2	Sulphite of soda	2½ ,,	125 gms.
	Carbonate of soda (crystals) ...	2¼ ,,	113 ,,
	Water	20 ,,	1000 c.c.s.

Add the acid to the water before dissolving the pyro.
For correct exposure, use equal parts of Nos. 1 and 2.
For known over-exposure, use 2 parts No. 1 and 1 part No. 2.

Hydroquinone.

No. 1.	Water	20 ozs.	1000 c.c.s.
	Hydroquinone	120 grs.	14 gms.
	Sulphite soda	2 ozs.	100 ,,
No. 2.	Water	20 ,,	1000 c.c.s.
	Carbonate of potash	4 ,,	200 gms.
	Bromide potassium	30 grs.	3·5 ,,

Dissolve the hydroquinone in the water before adding the sulphite. For use take equal parts of each.

Hydroquinone Developer for Lantern Plates.

(For Black Tones.)

Distilled water	20 ozs.	1000 c.c.s.
Hydroquinone	60 grs.	7 gms.
Sulphite soda	2 ozs.	100 ,,
Carbonate soda (crystals) ...	6 ,,	300 ,,
Bromide potassium	40 grs.	4·6 ,,

Dissolve the hydroquinone in the water and add the other ingredients in the order named.

Time of development, if exposed correctly, about 2 minutes. This developer may be used several times.

Pyro Developer.

(For Warm Tones.)

1.	Water	20 ozs.	1000 c.c.s.
	Nitric acid	20 drops	2 ,,
	Sulphite soda	4 ozs.	200 gms.
	Pyrogallic acid	1 oz.	50 ,,
2.	Water	20 ozs.	1000 c.c.s.
	Bromide ammonium (not potass)	3 ,,	150 gms.
	Liquid ammonia (·880) ...	1 oz.	50 c.c.s.

Add the acid to the water, and the other ingredients in the order named.

For use, take 1 part each of Nos. 1 and 2, and dilute with equal quantities of water. For still warmer tones, add 1 part more water, or again double the exposure and add one fourth more No. 2. This developer may be used several times.

BAYER CO., LTD.

Developer for "Pan" Paper.

Water	10 ozs.	1000 c.c.s.
Sodium sulphite (cryst.) ...	1¼ oz.	125 gms.
Hydroquinone	72 grs.	16 ,,
Soda carbonate (cryst.) ...	2½ ,,	250 ,,
Potass bromide...	48 ,,	11 ,,

Developer for "Tula" and "St. Luke's" Papers.

Potass metabisulphite... ...	48 grs.	1 gm.
Edinol crystals	24 ,,	½ ,,
Potass carbonate (cryst.) ...	144 ,,	3 gms.
Water	10 ozs.	100 c.c s.
Potass bromide (10 % solution)	6 drops	2 drops

The above developer, when freshly made, gives blue-black tones; when standing for some time, brown-black tones.

Developer for Bromide Paper.

A.	Edinol crystals	1 oz.	10 gms.
	Acetone sulphite crystals ...	5 ozs.	50 ,,
	Or—		
	Sodium sulphite	10 ,,	100 ,,
	Water	100 ,,	1000 c.c.s.
B.	Potass carbonate crystals ...	25 ,,	250 gms.
	Water	50 ,,	500 c.c.s.

For use, take 4 ozs. A, 1 oz. B, and 5 ozs. water, adding 5 drops of potassium bromide solution 10 per cent.

CADETT & NEALL, LTD.

(Developers for "Royal Standard" Plates.)

The following developers are equally suitable for Cadett "Lightning," "Special Rapid," "Cadett," "Professional," and "Ordinary" plates.

Avoirdupois weight.

Pyro Developer.

A.	Water	16 ozs.	1000 c.c.s.
	Sodium sulphite (crystals) ..	1 oz.	60 gms.
	Pyro	1 ,,	60 ,,
	Citric acid	20 grs.	1 gm.
B.	Water	16 ozs.	1000 c.c.s.
	Sodium sulphite (crystals) ...	4 ,,	240 gms.

C. Water	16 ozs.	1000 c.c.s.
Sodium carbonate (crystals) ...	4 ,,	240 gms.

To develop, take—

A.	1 oz.	1 part
B.	1 ,,	1 ,,
C.	1 ,,	1 ,,
Water*	8 ozs.	8 parts

Less of B will give a warmer tone to negative. If negatives are too yellow, use more of B.

The best printing colour is a brownish black, but for this colour do not carry development quite so far as with developers which give a bluish or greyish black image. These latter colours should be avoided.

A two-solution developer can be made from the above by dissolving the sulphite and carbonate *together* in 32 ozs. water and using 1 oz. A, 2 ozs. of mixture, and 8 ozs. water.

Eikonogen-Hydroquinone Developer

No. 1. Water	32 ozs.	1000 c.c.s.
Sodium sulphite (crystals) ...	4 ,,	120 gms.
Eikonogen	240 grs.	16 ,,
Hydroquinone	60 ,,	4 ,,
No. 2. Water	32 ozs.	1000 c.c.s.
Sodium carbonate (crystals) ...	8 ,,	240 gms.

To develop, take—

No. 1	2 ozs	2 parts
No. 2	1 oz.	1 part
Water*	1 ,,	1 ,,

Metol Hydro Developer.

A Water		16 ozs.
Metol		30 grs.
Hydroquinone		30 ,,
Sodium sulphite (crystals)		240 ,,
B. Water		16 ozs.
Potassium bromide		15 grs.
Sodium carbonate (crystals)		240 ,,

To develop take equal parts of A and B. Developer should be about 70 degrees F., and can be used repeatedly, but should be discarded as soon as discoloured, as it will then stain the film.

"Royal Standard" Lantern Plates.

Developer for Warm Tone Plates.

A. Water	16 ozs.	600 c.c.s.
Hydroquinone	120 grs.	10 gms.
Sodium sulphite (crystals) ...	1 oz.	30 ,,
B. Water	16 ozs.	600 c.c.s.
*Caustic soda	60 grs.	5 gms.
Potassium bromide	60 ,,	5 ,,

* More water gives less contrast and density.

C. Water	16 ozs.	600 c.c.s.
*Ammonium carbonate	120 grs.	10 gms.
Ammonium bromide	120 „	10 „

*The caustic soda should be fresh and dry. The ammonium carbonate should be in clear lumps. If covered with white, powdery bicarbonate from exposure to the atmosphere, this should be scraped off before weighing.

For Brown Tones: A, 1 oz.; B, 1 oz.; and C, 2 drachms.

For Purple Tones: A, 1 oz.; B, 1 oz.; and C, 3 drachms.

For Red Tones expose longer and use developer for purple Tones.

Cadett & Neall's "Dagas" Paper.

Development.—Metol hydroquinone should be used for developing "Dagas" paper, and should be made in strict accordance with the following formula:—

Metol	20 grs.
Hydroquinone	65 „
Sodium carbonate (cryst.)	1½ ozs.
Sodium sulphite	1½ „
Water	20 „
Potassium bromide (10%)	20 drops

This developer will keep for some considerable time in well-stoppered bottles, but when once used should not be put back with the stock solution.

Cadett & Neall's "Cadett" Bromide Papers.

No. 1.—Metol Developer (*One Solution only*).

Distilled or soft water... ...	80 ozs.	2000 c.c.s.
Metol	1 oz.	25 gms.
Sodium sulphite (pure recryst.)	5 ozs. avd.	125 „
Sodium carbonate (cryst. washing soda, select translucent pieces)	6¾ „ „	170 „

These must be completely dissolved in the order named, the water not being colder than 60 deg. F. Take one part of the above one-solution developer, and dilute it with one to three parts of water.

After fixing and thorough washing if the prints be placed in a solution of alum—

Alum	2 ozs. avd.	25 gms.
Water	80 „ (fl.)	1000 c.c.s.

and then well washed, mounting will be greatly facilitated.

Bromide prints should be dried before mounting, the mountant being applied to the dry print.

For very brilliant prints we recommend the following:—

No. 2.—Metol Hydroquinone.

A. Metol	100 grs.	6 gms.
Hydroquinone	50 „	3 „
Sodium sulphite (cryst. and *fresh*)	2 ozs. avd.	20 „
Water to make altogether ...	40 „ (fl.)	1000 c.c.s.

B. Sodium carb. (cryst.), *washing* soda, select translucent pieces	1 oz. avd.	25 gms.
Potassium bromide	60 grs.	3 ,,
Water to make altogether ...	40 ozs. (fl.)	1000 c.c.s.

Equal parts of Nos. 1 and 2 to make developer.
No clearing solution required.

Toning.

The following formulæ give excellent results. Prepare the following three solutions :—

No. 1. Copper sulphate (pure)	1 oz. avd.	
Boiled or distilled water	10 ozs. (fl.)	
No. 2. Neutral potassium citrate	8 ,, avd.	
Boiled or distilled water	80 ,, (fl.)	
No. 3. Potassium ferricyanide	1 oz. avd.	
Boiled or distilled water	10 ozs. (fl.)	

The potassium ferricyanide solution should be kept in the dark in a well-corked bottle.

To make the toning solution take—

Solution No. 1	1 oz. (fl.)
,, No. 2	8 ozs. (fl.)
,, No. 3	7 drachms (fl.)

Add No. 1 to 2 and then add No. 3. The complete solution can then be diluted with one or two or more parts of water if desired, especially should toning proceed too rapidly, where slight toning for rich brownish black is desired.

The following method for obtaining Sepia Tones can be strongly recommended :—

After fixing and thoroughly washing, place the print in the following solution.—

Tincture of iodine (British Pharmacopœia) ...	1 oz.
Water...	10 ozs.

The solution can be made stronger or weaker if desired. It need not be thrown away after use, but returned to the bottle and fresh tincture added as required. It should not be left in strong daylight.

Rock the solution over the print, so as to help even action. If warm blacks are wanted, the solution must act only for a short time, and not be too strong. If for warm sepia tones, the solution must act until the image is thoroughly converted into silver iodide, which will take about five minutes ; the print then looks like a negative, the high lights and white portions becoming blue-black by formation of iodide of starch in papers containing starch.

Wash the print in running water to remove any free iodine, and then place the print in the following solution :—

Sodium sulphite	1 oz.
Water...	10 ozs.

After a few minutes the iodine will be removed from the starch, and the print becomes white again. Then wash for ten minutes, and place the print in the following solution :—

Ammonium hydro-sulphuret (solution fortior)	1 oz.
Water	20 ozs.

This solution is also known as ammonium sulphide solution ; it has a very unpleasant smell, and the windows of the room in which it is used should be opened. The print immediately changes from warm black to complete sepia in this solution, according to the length of time the print has been in the iodine solution.

The tones are very fine and easily obtained, and we believe them to be as permanent as any silver printing process can give.

B. J. EDWARDS & CO.

Hydroquinone Developer.

No. 1. Hydroquinone	¼ oz.	7 gms.
Sulphite of soda	1 ,,	30 ,,
Bromide of potassium... ...	7 grs.	½ gm.
Distilled boiling water to make	12 ozs.	340 c.c.s.
No. 2. Carbonate of potash	½ oz.	15 gms.
Distilled water to make ...	12 ozs.	340 c.c.s.

First dissolve the hydroquinone, and then add the sulphite and bromide.

For use, mix equal parts of Nos. 1 and 2.

Eikonogen Developer.

Eikonogen	½ oz.	14 gms.
Carbonate of potash	1 ,,	30 ,,
Sulphite of soda	2 ozs.	60 ,,
Distilled boiling water ...	20 ,,	600 c.c.s.

First dissolve the eikonogen, then the sulphite, and lastly the car bonate of potash.

Instead of mixing the developers, the development may be commenced with eikonogen, and when the detail is sufficiently out, hydroquinone substituted for it, without waiting to wash the negative, and the development finished with this, or in case of much over-exposure with the following hydroquinone re-developer :—

Hydroquinone Re-developer.

No. 1. Hydroquinone	¼ oz.	7 gms.
Sulphite of soda...	2 ozs.	60 ,,
Bromide of potassium	¼ oz.	7 ,,
Distilled boiling water to make	12 ozs.	340 c.c.s.
No. 2. Carbonate of soda (washing soda)	2 ozs.	60 gms.
Sulphite of soda	2 ,,	60 ,,
Distilled water to make ...	12 ,,	340 c.c.s.

For use, mix equal parts of Nos. 1 and 2.

ELLIOTT & SONS' FORMULÆ

For Barnet "Red Seal" and "Ortho" Plates.

Developer.

Stock Solution A.—Dissolve 100 grs. of potass. metabisulphite in water, then add 1 oz. pyro and 60 grs. potassium bromide, and make up with water to measure 8 ozs.

No. 1 Solution.

Stock solution A	2 ozs.
Water	18 ,,

No. 2 Solution.

Soda carbonate crystal	2 ozs.
Soda sulphite	2½ ,,
Water to make	20 ,,

For use, take equal parts Nos. 1 and 2. For soft negatives or for portraiture, etc., take 1 part of No. 1, 2 parts No. 2, and 1 part of water.

For "Barnet" Medium Extra Rapid and "Rocket" Plates and "Barnet" Roll Films :—

No. 1 Solution.

Pyro	1 oz.	12 gms.
Potass bromide	60 grs.	2 ,,
Water	80 ozs.	1000 c.c.s.
Pure nitric acid	20 drops	·5 c.c.

No. 2 Solution.

Soda sulphite	9 ozs.	112 gms.
Soda carb. crystal	8 ,,	100 ,,
Water	80 ,,	1000 c.c.s.

For *ordinary use*, equal parts of Nos. 1 and 2. For *under exposure* add more of No. 2, or dilute the developer with water. For over exposure add more of No. 1, or a few drops of a 10 per cent. solution of potassium bromide.

"Barnet" Lantern Transparency Plates.

For Cold or Warm Tones.

Instructions for Use.

Contact Printing.—For black tones the exposure required is about 10 seconds at a distance of 1 foot from an ordinary gas flame ; the developer to be used in either No. 1 or 2.

To secure warm tones it is necessary to increase the exposure to 2 or 3 minutes and use formula either No. 3 or 4.

To obtain still warmer (reddish) tones, increase the exposure still further to 5 or 6 minutes and develop with formula No. 5.

Cold Black Tones.

A.

No. 1. Metol	... 400 grs.	11 gms.
Soda sulphite	... 8 ozs.	100 ,,
Water	... 80 ,,	1000 c.c.s.

B.

Carbonate of potash ...	...1200 grs.	34 gms.
Ammonium bromide ...	.. 240 ,,	7 ,,
Potassium bromide ...	... 480 ,,	14 ,,
Water	... 80 ozs.	1000 c.c.s.

Take equal parts of A and B.

Note.—The ammonium bromide is necessary for the production of absolutely cold black tones; a larger quantity is not recommended, as it tends to produce a slight veil in the high lights.

Length of time in developing about 2 minutes.

Warm Black Tones.

A.

No. 2. Hydroquinone	... 640 grs.	18 gms.
Soda sulphite	... 8 ozs.	100 ,,
Potass. bromide... ...	... 120 grs.	3 ,,
Citric acid	... 240 ,,	7 ,,
Water	... 80 ozs.	1000 c.c.s.

B.

Sodium hydrate ...	... 640 grs.	18 gms.
Water	... 80 ozs.	1000 c.c.s.

Take equal parts of A and B.

This produces a very pleasing warm black. Length of time in developing about 2 minutes.

Warm Brown Tones.

A.

No. 3. Pyro	... 1 oz.	12·5 gms.
Soda sulphite	... 4 ozs.	50 ,,
Water	... 80 ,,	1000 c.c.s.

B.

Carbonate of ammonia	... 900 grs.	26 gms.
Potassium hydrate ...	... 750 ,,	21 ,,
Ammonium bromide ...	... 600 ,,	17 ,,
Water	... 80 ozs.	1000 c.c.s.

Take equal parts of A and B.

Length of time in developing about 2 minutes.

Or the following may be used :—

No. 4.—Take equal parts of No. 2 formula and add to each ounce (100 c.c.s.) 3 grs. (·6 gm.) each of carbonate of ammonia and ammonium bromide.

Length of time in developing about 3 or 4 minutes.

Very Warm (Reddish) Tones.

No. 5.—Take equal parts of No. 2 formula and add to each ounce (100 c.c.s.) 6 grs. (1·2 gm.) each of carbonate of ammonia and ammonium bromide.

Length of time in developing about 8 minutes.

Barnet Bromide Paper.

(Extra Rapid.)

Metol Developer.

A. Metol	400 grs.	11 gms.
Sodium sulphite	8 ozs.	100 ,,
Potass. bromide...	50 grs.	1·4 gm.
Water	80 ozs.	1000 c.c.s.
B. Potass. carbonate	8 ozs.	100 gms.
Water	80 ,,	1000 c.c.s.

Take 3 ozs. of A and 1 oz. of B.

The image should appear in a few seconds, and development will be complete in about 2 minutes. Rinse in 3 changes of water and fix in fixing bath as above. (No acid bath is necessary with this developer.)

Metol-Hydroquinone.

One-Solution Developer.

Water	80 ozs.	1000 c.c.s.
Metol	200 grs.	6 gms.
Soda sulphite	6 ozs.	75 ,,
Hydroquinone	150 grs.	4 ,,
Potass. carbonate	2 ozs.	25 ,,
Potass. bromide	50 grs.	1·5 gm.

Development will be complete in from 1 to 2 minutes.

For softer prints, either of the above may be diluted with an equal bulk of water just before use.

After fixing, wash thoroughly in several changes of water for at least 2 hours, squeegee off the superfluous moisture, and hang up to dry.

Barnet Gaslight Paper.

Developer.

Water	10 ozs.	1000 c.c.s.
Metol	8 grs.	1·75 gms.
Hydroquinone	30 ,,	7·0 ,,
Soda sulphite	350 ,,	75·0 ,,
Soda carbonate	300 ,,	70·0 ,,
Potassium bromide	3 ,,	·7 gm.

The ingredients should be dissolved in the order named. If softer results are required the developer should be diluted with an equal bulk of water and a somewhat longer exposure be given.

BARNET MATT P.O.P.

Toning Baths.

A.	Ammonium sulphocyanide ...	80 grs.	2 gms.
	Water	80 ozs.	1000 c.c.s.
B.	Gold chloride	15 grs.	1 gm.
	Water	15 drs.	60 c.c.s.
C.	(To be made up fresh every day)		
	Sulphite soda	15 grs.	1 gm.
	Water	15 drs.	60 c.c.s.

For use take 16 ozs. A, 2 drachms B, and 2 drachms C.

A good rich brown tone takes about 3 minutes, but for colder tones toning should be carried further. Judge the tone by looking on the surface of the prints.

Another good bath is—

Phosphate soda	60 grs.	3 gms.
Gold chloride	2 ,,	1 gm.
Water	40 ozs.	1000 c.c.s.

Keep this bath for an hour before use, and throw it away as soon as the prints are toned, as it will not keep long. The above will tone 24 half-plates, and tones very much quicker than the sulphocyanide bath.

BARNET SELF-TONING PAPER.

Print as for the ordinary P.O.P., and immerse for about five minutes in the following solution without washing :—

Alum (powdered)	1½ ozs.	75 gms.
Ammonium sulphocyanide ...	20 grs.	2 ,,
Water	20 ozs.	1000 c.c.s.

Wash for ten minutes and fix in hypo 3 ozs., water 20 ozs. Wash for two hours in running water.

GEM DRY PLATE COMPANY'S FORMULÆ.

DEVELOPER FOR GEM "SALON" AND "METEOR" PLATES.

A.	Pyrogallic acid...	1 oz.	10 gms.
	Pot. metabisulphite	1 ,,	5 ,,
	Pot. bromide	20 grs.	0·4 ,,
	Water	50 oz.	500 c.c.s.
B.	Sodium carbonate	6 ozs.	60 gms.
	Sodium sulphite	8 ,,	80 ,,
	Water	50 ,,	500 c.c.s.

To develop mix equal parts of A and B. For soft portrait negatives mix one part of A with two parts of B.

Lantern Plates.

Developer for Cold or Warm Tones.

(Cold Tones.)

For Lantern Plates (Warm Tones) and Chloride Plates.

A.	Hydroquinone	... 120 grs.	8 gms.
	Potass. bromide ...	... 180 ,,	12 ,,
	Potass. metabisulphite...	... 120 ,,	8 ,,
	Water	... 30 ozs.	900 c.c.s.
B.	Caustic potash (sticks)	... 240 grs.	16 gms.
	Water	... 30 ozs.	900 c.c.s.

Use equal parts of A and B.

For warmer tones double the exposure and dilute the developer with water, adding a few drops of a 10 per cent. solution of potassium bromide.

For chloride plates, dilute with water 4 to 8 times.

(Warm Tones.)

C.	Ammonium carbonate... ...	1 oz.	10 gms.
	Ammonium bromide	1 ,,	10 ,,
	Water	20 ozs.	200 c.c.s.

To obtain extra warm tones on "Gem" red lantern plates, give over exposure and develop with one part of solution A and B and one part of C, increasing C as the exposure is lengthened.

Gem P.O.P.

Sulphocyanide Bath.

A.	Sulphocyanide of ammonium	30 grs.	2 gms.
	Water	10 ozs.	284 c.c.s.
B.	Gold chloride	2 grs.	0.13 gm.
	Water	10 ozs.	284 c.c.s.

Into a portion of A pour in slowly an equal portion of B. Wash print in running water before toning. After toning, rinse in water, and transfer to fixing bath. The above quantity will tone at least 1 sheet of paper.

JOHN J. GRIFFIN & SONS, LTD.

Velox Papers.

Developer.

(Dissolve chemicals in the order named.)

Water...	10 ozs.
Metol	7 grs.
Hydroquinone	30 ,,
Sulphite soda (desiccated)	110 ,,
Carbonate soda (desiccated)	150 ,,
10 per cent. solution bromide potassium ...	40 drops

This solution will keep indefinitely if placed in bottles, filled to the neck and tightly corked,

It should be used full strength for "Regular," but can be diluted with equal parts of water when Special Velox is developed.

Acid Fixing Bath.

(Dissolve chemicals in the order named.)

Water	64 ozs.
Hyposulphite of soda	16 ,,

After the above bath has been made, add to it the following hardening solution :—

Water	5 ozs.
Sulphite soda (desiccated)	¼ oz.
Glacial acetic acid (50 per cent.)	1½ ,,
Powdered alum	½ ,,

This solution can be used repeatedly, and one pint of it will fix at least one-half gross 5 × 4 prints.

If sulphite and carbonate soda in crystal form are substituted for desiccated, double the quantities mentioned should be used.

GRIFFIN'S SNOW-WHITE BROMIDE PAPER.

Development.—To develop the image, first plunge the paper in clean water, place at the bottom of a clean porcelain dish, and apply evenly any of the following developers :—

Amidol.

Amidol	70 grs.
Sodium sulphite (cryst.)	650 ,,
Potassium bromide	4 ,,
Water...	20 ozs.

Fixing.—After development rinse print in water, and fix in—

Soda hyposulphite	1 oz.
Water...	10 ozs.

for ten minutes, then wash for half an hour in running water.

CARBONA P.O.P.

Combined Toning and Fixing Bath.

The following bath will give excellent results :—

Distilled water	35 ozs.	2000 c.c.s.
Hypo	4½ ,,	250 gms.
Alum	¾ oz	43 ,,
Sulphocyanide of ammonia ...	150 grs.	20 ,,
Sodium chloride...	1½ ozs.	86 ,,

After a short time the liquid gets thick. It must then be left for eight days and the clear liquid finally poured off. Then add to the clear solution—

Gold chloride	15 grs.	1 gm.
Water	3½ ozs	100 c.c.s

Platinum Toning Bath.

For the finest black results the following platinum bath should be used :—

Stock Solution.

Potassium chloroplatinite ...	15 grs.	1 gm.
Water	3½ ozs.	100 c.c.s.

For use take—

Stock solution	5½ drachms	20 c.c.s.
Citric acid	80 grs.	5 gms.
Water up to	10 ozs.	280 c.c.s.

GRIFFIN'S SPECIAL P.O.P.

Directions for Separate Toning and Fixing.

Wash prints for 10 minutes, then place in—

Gold chloride	1 gr.	·23 gm.
Sulphocyanide of ammonium...	10 grs.	2·3 gms.
Water	10 ozs.	1000 c.c.s.

Remove when the desired colour is attained and fix in—

Water	10 ozs.	1000 c.c.s.
Hypo	1 oz.	100 gms.

Then wash and dry as usual.

GRIFFIN'S PROFESSIONAL P.O.P.

Sulphocyanide Bath.

Gold chloride	1½ grs.	·1 gm
Sulphocyanide of ammonia ...	15 ,,	1 ,,
Water	25 ozs.	700 ,,

Fixing Bath.

Hypo	2½ ozs.	125 gms.
Water	20 ,,	1000 c.c.s.

GOLDONA SELF-TONING PAPER.

The prints are plunged straight into the fixing bath, which may be weak or strong according to tone desired :—

For warm tones, fix for 15 minutes in—

Hypo (cryst.)	2 ozs.
Water	10 ,,

For colder tones, fix for 10–15 minutes in—

Hypo (cryst.)	4 ozs.
Water	10 ,,

Still colder tones may be obtained by more prolonged immersion. The toning action is not unduly rapid, and hence is quite even and well under control. The temperature of the bath should not be less than 60° to 65° Fahr. Finally wash the prints for 1 hour in running water, and dry as usual.

"Cyko" Plates, "Snapshot" and "Studio."

Pyro-soda.

A.	Water	10 ozs.	1000 c.c.s.
	Sulphite of soda (cryst.) ...	1 oz.	100 gms.
	Pyrogallic acid	60 grs.	14 ,,
	Bromide of potassium... ...	1 gr.	·23 gm.
B.	Water	10 ozs.	1000 c.c.s.
	Carbonate soda (cryst.) ...	1 oz.	100 gms.

Take equal parts of A and B.

Metol-Hydroquinone.

(One-solution).

Water	10 ozs.	1000 c.c.s.
Metol	13 grs.	3 gms.
Sodium sulphite (cryst.) ...	1 oz.	100 ,,
Hydroquinone	55 grs.	12·5 ,,
Sodium carbonate (cryst.) ...	750 ,,	172 ,,
Bromide of potassium	2 ,,	·5 gm.

"Gaslyt" Lantern Plates.

Developing Baths.

For Black Tones.

Water...	8 ozs.
Metol	4 grs.
Sodium sulphite crystals	75 ,,
Hydroquinone	16 ,,
Sodium carbonate crystal	280 ,,
Potassium bromide	8 ,,

For Warm or Sepia Tones.

Solution (as for black tones)	1 oz.
Water...	2 ozs.
Potassium bromide solution, 10 per cent. ...	10 drops.

or 1 gr. of the solid substance.

With the above developer, assuming exposure to have been correct, development should be complete in about 2 minutes for black tones; development for warm tones is complete in about 4 minutes.

On completion of development, the plate should be immersed without previous washing, in an acid fixing bath, where it should remain for about 4 minutes.

Formula as follows :—

Stock solution.

Sulphite of soda	4 ozs.	200 gms.
Citric acid...	½ oz.	25 ,,
Water, to make	20 ozs.	1000 c.c.s.

To prepare the fixing bath dissolve :—

Stock solution as above	6 drs.	40 c.c.s.
Soda hyposulphite	4 ozs.	200 ,,
Water	20 ,,	1000 ,,

THE ILFORD FORMULÆ.

For Ilford "Ordinary," "Zenith," "Monarch," "Chromatic," and other Plates.

Stock Solutions.

A. Water	5½ ozs.	550 c.c.s.
Nitric acid	20 minims	1 c.c.
Pyrogallic acid	1 oz.	100 gms.

This solution will keep good for several weeks.

Or—

B. Water	5½ ozs.	550 c.c.s.
Potassium metabisulphite ...	70 grs.	15 gms.
Pyrogallic acid	1 oz.	100 ,,

This solution will keep good for several months.

Working Solutions.

No. 1.

Stock solution of pyro, A or B	1—2 ozs.	100—200 c.c.s.
Water to make up to	20 ,,	1000 ,,

No. 2.

Sodium carbonate, crystals (not bicarbonate) (avoirdupois)	2 ozs.	100 gms.
Sodium sulphite (avoirdupois)	2 ,,	100 ,,
Potassium bromide	20 grs.	2 ,,
Water to make up to	20 ozs.	1000 c.c.s.

For normal exposures take equal quantities of Nos. 1 and 2.

The quantity of stock solution to be used must be regulated by the quality of negative desired. When a full quantity is used, the result is a slowing of the plate, and, at the same time, greater density or contrast of light and shade.

Pour the developer carefully over the plate, avoiding air bubbles, rock the dish, carefully keeping the plate well covered with solution. To obtain proper density, allow the plate to remain after all detail is out. Judge of this by looking through the plate.

To compensate for errors of exposure, the proportions of Nos. 1 and 2 can be varied thus: for under-exposure use more of No. 2 than of No. 1, and for over-exposure more of No. 1 than of No. 2. It is a good plan, when there is a doubt as to the exposure being correct, to commence the development with twice the quantity of No. 1 than of No. 2, and add more of No. 2 if found desirable. To compensate for under-exposure, the mixed developer can also be diluted with water, of course allowing a longer time for its action.

Alum Bath.—After developing, wash the plate well under the tap, and immerse for a few minutes in alum, 1½ oz.; water, 20 ozs.

Fixing.—Wash well again, and fix as usual. Hyposulphite of soda, 1 lb.; water, 40 ozs. Allow to remain in this bath for several minutes after fixation is apparently completed.

Never omit the alum bath in hot weather or under other conditions likely to produce frilling.

Ilford P.O.P.

Working Instructions.

Printing.—This should be done in shade by preference, unless negatives are specially strong in contrast. The image loses very little depth in toning, etc.

First washing.—For 10 minutes in several changes.

Hardening Bath.—Soak the prints in

Alum	1½ oz.
Common salt...	1 ,,
Water...	20 ozs.

for 5 to 10 minutes, keeping them moving all the time.

Second washing.—For 10 minutes in several changes.

Toning.—Any of the recognised formulæ for this class of paper may be used, but for simplicity and excellence of results we recommend the following. Make up the following stock solutions :—

No. 1. Ammonium sulphocyanide	100 grs.
Water	10 ozs.
Sodium sulphite	10 grs.
Water...	10 ozs.

This solution must be made up only on the day of using; any left must be thrown away.

3. Gold chloride	15 grs.
Water...	15 ozs.

When mixing either of the following toning baths, bear in mind that this solution must be added last of all.

For the usual toning bath, take 2 ozs. of each of Nos. 1 and 3 and make up to 20 ozs. with water.

For *warm* tones and Special P.O.P. add 1½ to 2 ozs. of No. 2 to the above bath just before toning, and withdraw prints according to tone desired.

Third washing.—For 5 minutes in several changes.

Fixing.—Use new solution for each batch of prints. The following is best strength :—

Hypo	3 ozs.
Water	20 ,,

Fixation is complete in about 10 minutes.

Final washing.—For at least 2 hours in running water, or many changes.

Mounting.—Mount with starch paste in the usual way. Prints thus treated and passed through roll give a fine glossy surface, better than albumen. This paper will also give prints of enamelled surface by squeegeeing down on glass in the usual way.

Special notes.—Do not use any excess of sulphocyanide or sulphite over the quantity mentioned.

Use the washing water and all solutions as cold as possible.

Keep the prints moving whilst in the various solutions.

Ilford Bromide Paper and Opals

Development.

No. 1. Metol	50 grs.	5·0	gms.
Hydroquinone	25 ,,	2·5	,,
Sodium sulphite	1 oz.	50	,,
Water up to	20 ozs.	1000	c.c.s.
No. 2. Sodium carbonate (crystals) ...	½ oz.	25	gms.
Potassium bromide	30 grs.	3	,,
Water up to	20 ozs.	1000	c.c.s.

Take equal quantities of No. 1 and No. 2.

It is important to note that no clearing solution is required with this developer.

Alternative Method of Development.

Make the following solutions and use when cold :—

No. 1. Sulphate of iron...	2½ ozs.	250	gms.
Sulphuric acid	15 drops	3	c.c.s.
Warm water up to	10 ozs.	1000	,,
No. 2. Neutral potassium oxalate ...	10 ozs.	250	gms.
Potassium bromide	20 grs.	1	gm.
Warm water up to	40 ozs.	1000	c.c.s.

For use, add 1 oz. No. 1 to 4 ozs. No. 2, not *vice versa*.

In cases of over-exposure or weak negatives, it is advisable to use half new and half old developer to give greater brilliancy. Development is complete when image appears fully out. After development and without washing, immerse the prints for about 2 minutes in clearing solution, pour off and repeat.

Clearing Solution.

Water	80 ozs.	1000	c.c.s.
Glacial acetic acid	½ oz.	6·5	,,

Then wash thoroughly for about 10 minutes in several changes of water. All the acid must be removed, or fading of prints will result.

Fixing.

Water	20 ozs.	1000	c.c.s.
Hyposulphite of soda (avd.) ...	3 ,,	150	gms.

Allow 15 minutes for thorough fixation. Use fresh solution for each batch of prints.

After fixing, wash for 2 hours in running water or in frequent changes. Allow prints to dry naturally. Work with clean hands and clean dishes.

Ilford Formulæ in Metric Measures.

Ilford Plates.

Stock Solutions.

A. Pyro	...28·4 gms.	(1 oz.)
Nitric acid	20	drops
Water	150	c.c.s.
B. Pyro	28·4	gms.
Potassium metabisulphite	5	,,
Water	150	c.c.s.

Working Solutions.

No. 1.	Stock solution of pyro A or B	25—50	c.c.s.
	Water to make up to	500	,,
No. 2.	Sodium carbonate	50	gms.
	Sodium sulphite	50	,,
	Potassium bromide	1·2	gm.
	Water to make up to	500	c.c.s.

Alum Bath.

Alum	30	gms.
Water	400	c.c.s.

Fixing.

Hypo	400	gms.
Water	1000	c.c.s.

Ilford P.O.P.

Hardening Bath.

Alum	45	gms.
Common salt	30	,,
Water	600	c.c.s.

Toning.

No. 1.	Ammonium sulphocyanide	8	gms.
	Water	350	c.c.s.
No. 2.	Sodium sulphite	0·8	gm.
	Water	350	c.c.s.
No. 3.	Gold chloride (15 gr. tube)	1	gm.
	Water	425	c.c.s.

Fixing.

Hypo	75	gms.
Water	500	c.c.s.

Ilford Bromide Paper and Opals.

Developer.

No. 1.	Metol	4	gms.
	Hydroquinone	2	,,
	Sodium sulphite	35	,,
	Water up to	700	c.c.s.
No. 2.	Sodium carbonate	17½	gms
	Potassium bromide	2·4	,,
	Water up to	700	c.c.s.

Fixing.

Hypo	100	gms.
Water	500	c.c.s.

Developer.

No. 1.	Sulphate of iron	50	gms.
	Sulphuric acid	10	drops
	Warm water up to	200	c.c.s.
No. 2.	Potassium oxalate	200	gms.
	Potassium bromide	1	gm.
	Warm water up to...	800	c.c.s.

Clearing Solution.

Glacial acetic acid...	10	c.c.s.
Water	1600	,,

Platona.—Ilford Platinum Paper.

Printing.

Printing frame and pad should be quite dry.

Print until all details are faintly visible. Examine in weak light only.

Developing Formula.—Stock Solution.

Potassium oxalate	2	ozs.
Potassium phosphate	½	oz.
Water	14	ozs.

This solution is better if slightly acid ; if it is not so, 60 grs. oxalic acid should be added.

If unable to obtain potassium phosphate, the sodium phosphate may be substituted, but the former is preferable.

Dissolve the salts in hot water and allow to cool. This solution will keep indefinitely.

For use, take 1 part stock solution and 1 part water.

Develop in weak artificial or diffused light, floating prints face downwards in the solution. The image does not lose in fixing.

Fixing.

Pure hydrochloric acid	1	oz.
Water...	80	ozs.

Immerse prints for about five minutes each in three consecutive baths, and then give them a final washing in water for fifteen minutes.

The prints are then ready to be dried and mounted.

Kalona.—The Ilford Self-Toning Paper.

The printing is done in the same way and to the same depth as with Ilford P.O.P.

The prints are then, without previous washing, slipped rapidly one by one face upwards into the following solution :—

Alum (powdered)	1½ oz.	30 gms.
Ammonium sulphocyanide ...	20 grs.	1 gm.
Water	20 ozs.	400 c.c.s.

They must be constantly turned over in the solution for five minutes to allow of an equal action on all parts. With very little

practice a large number can be manipulated at the same time. The prints should next be washed for ten minutes in running water or repeated changes and fixed for ten minutes in a solution of—

Hypo	3 ozs.	75 gms.
Water	20 ,,	500 c.c.s.

They are then finally washed for two hours in the same way as Ilford P.O.P.

It will be found convenient to make up the bath from the following stock solutions, which will keep indefinitely :—

No. 1.

Alum (powdered)	8 ozs.	200 gms.
Water	100 ,,	2500 c.c.s.

No. 2

Ammonium sulphocyanide ..	100 grs.	8 gms.
Water	10 ozs.	350 c.c.s.

For use mix 18 ozs. of No. 1 with 2 ozs. of No. 2.

It is essential to work with clean hands and dishes.

In tropical climates the following may be used instead of the ordinary formula :—

Ammonium sulphocyanide ...	20 grs.	2·3 gms.
Chrome alum	20 ,,	2·3 ,,
Water	20 ,,	1000 c.c.s.

The colour of the prints is not affected.

A fresh fixing bath should be used for each batch of prints, but care must be taken to have all the solutions as nearly alike in temperature as possible.

The alum and sulphocyanide solution *may* be omitted and the prints put into a solution of—

Common salt...	1 oz.
Water...	20 ozs.

for 5 minutes and then fixed, but the resulting tone is warmer than that obtained by the use of the sulphocyanide. It is, however, permanent. Prints treated in this way are not so suitable for enamelling.

Ilford Gaslicht Paper and "Carbon Surface" Gaslight Paper.

Developer.

Metol	5 grs.	1 gm.
Sodium sulphite	½ oz.	50 gms.
Hydroquinone	20 grs.	4·6 ,,
Sodium carbonate (crystals) ...	½ oz.	50 ,,
10% solution of potassium bromide	10 minims	2·5 c.c.s.

(Potass. bromide, 1 oz. ; water up to 10 ozs.)

Water	10 ozs.	1000 ,,

To the 10 ozs. of warm (but not boiling) water add each salt, in succession, when the previous one is dissolved. It should be noted that a very minute quantity of potassium bromide is required. The developer should be clear and colourless when made, and will remain in good condition in a tightly corked or stoppered bottle for a considerable time, but it is unfit for use if it becomes discoloured.

The following Amidol Developer may be used for Ilford Bromide and Gaslight Papers : –

Amidol	20 grs.	4·6 gms.
Sodium sulphite...	½ oz.	50 ,,
Water	10 ozs.	1000 c.c.s.
Potass bromide as required.		

The developer must be fresh and not discoloured. For bromide papers add 4 drops of a 10 per cent. solution of potass bromide to each ounce of developer ; for gaslight papers add 2 drops to each ounce.

"ILLINGWORTH" P.O.P.

Stock Solution.

A. Sulpho-cyanide of ammonia ...	100 grs.	20 gms.
Water	10 ozs.	1000 c.c.s.
B. Chloride of gold	15 grs.	1 gm.
Water	15 ozs.	450 c.c.s.

The above stock solutions will keep indefinitely, and should be made at least one day before using.

For use, take 2 ozs. of A solution, make up to 20 ozs. with water, and then add 2 ozs. of B. Mix half-an-hour before using. Keep the prints constantly moving whilst in the above bath, and remove when, on looking through them, the colour is a little warmer than is required when finished.

Combined Toning and Fixing Solution.

With this formula no washing is required before toning, the print being placed direct into the solution from the printing frame. It will keep and can be used soon after mixing :—

Hyposulphite of soda	2 ozs.
Acetate of lead	16 grs.
Chloride of gold	1 gr.
Common salt	1½ ozs.
Water	16 ,,

Dissolve hypo and acetate of lead separately in warm water, using 8 ozs. of water for each, pour the lead acetate into the hypo solution, stirring vigorously, then add the salt and gold—allow sediment to settle before using.

Keep prints in solution until desired tone is obtained, being careful to keep prints in motion to prevent stains or marks.

Illingworth's Carbon Tissue.

The sensitising solution is made up in the proportion as follows :—

7 ozs. bichromate of potash.
1 gallon hot water.
3 drachms of liquid ammonia.

Allow to cool, and place in a convenient jar ; when cool it is ready for use, and can be used over and over again.

Illingworth's Bromide Papers.

Amidol Developer.

Amidol	50 grs.
Sulphite of soda	600 ,,
Bromide of potassium	10 ,,
Water	20 ozs.

This developer must be used within three days after mixing.

Illingworth's Zigo Paper.

Fixing.—The print changes colour as soon as placed in the "hypo" solution, and passes through the following tones :—

1st red. 2nd brown. 3rd purple.

When the desired tone is reached, remove print from the hypo solution and place in clean cold water, which must be constantly changed, or allowed to run for half an hour.

To Fix.—Place the prints direct, without previous washing, into one of the following solutions :—

For Brown or Purple Tones.

Hyposulphite of soda (hypo) 4 ozs. (4 table-spoonfuls)
Water ... ... 20 ,, (1 pint)

The above quantity will fix about 24 quarter-plate prints, or 12 half-plates.

It is advisable to dissolve the hypo in a little warm water, then make up the pint with cold water.

For Red Tones.

Take 10 ozs. ($\frac{1}{2}$ a pint) of above solution and make up with water to 20 ozs. (1 pint).

Note.—The prints should always remain in the hypo solution at least six minutes to become thoroughly fixed.

Note.—When a number of prints are fixed or washed at one time, it is most important that they should be kept moving in the solution, and not allowed to stick together, otherwise stains and marks will result.

To Harden.—"Glossy" prints for enamelling must be hardened after washing by immersion in one of the following solutions :—

Alum...	2 ozs.
Water	20 ,, (1 pint)
Or—	
Formalin (40 %)	1 oz.
Water	20 ozs. (1 pint)

Either of the above can be kept in a stock bottle and used over and over again ; wash prints for about ten minutes after using above.

Illingworth's Zigas Paper.

Developer.

Metol	7 grs.	2·6 gms.
Hydroquinone	30 ,,	6 ,,
Sulphite of soda (crystals)	220 ,,	44 ,,
Carbonate of soda (crystals)	400 ,,	80 ,,
10% bromide of potassium...	30 to 40 dps.	6 to 8 c.c.s.
Water...	10 ozs.	1000 ,,

The print should be fully developed in about 30 seconds if correctly exposed. It is then given a very quick rinse in water and placed in the fixing bath, which, in order to avoid stains, is preferably an acid one,

4 ozs. of hypo.
20 ,, water.
1 oz. of acid solution (as follows).

The acid solution can be made up and kept as a stock solution.

4 ozs. sulphite of soda.
½ ,, sulphuric acid.
20 ,, water.

Dissolve the sulphate of soda, in the 20 ozs. of water, and then add the sulphuric acid very slowly and with constant stirring.

THE IMPERIAL COMPANY'S FORMULÆ.

"Standard" Developer.

No. 1.

Pyrogallic acid	55 grs.	6 gms.
Metol	45 ,,	5 ,,
Metabisulphite of potash ...	120 ,,	14 ,,
Bromide of potassium	20 ,,	2 ,,
Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.

No. 2.

Carbonate of soda (washing soda)	4 ozs.	200 gms.
Water (boiled or distilled) to...	20 ,,	1000 c.c.s.

For use take equal parts of No. 1 and No. 2.

"Universal" Developer.

No. 1.

Metol	40 grs.	5 gms.
Hydroquinone	50 ,,	6 ,,
Sulphite of soda	120 ,,	14 ,,
Bromide of potassium	15 ,,	2 ,,
Water (boiled or distilled) to ..	20 ozs.	1000 c.c.s.

No. 2.

Caustic potash	180 grs.	21 gms.
Water (boiled or distilled) to ...	20 ozs.	1000 c.c.s.

For use, take equal parts of No. 1 and No. 2.

Pyro-soda Developer.

Stock Solution.

Pyrogallic acid	1 oz.	83 gms.
Bromide of potassium	60 grs.	13 ,,
Metabisulphite of potash ...	50 ,,	10 ,,
Water (boiled or distilled) to...	12 ozs.	1000 c.c.s.

No. 1.

Stock solution	3 ozs.	150 c.c.s.
Water (boiled or distilled) ...	20 ,,	1000 ,,

No. 2.

Sulphite of soda	2 ozs.	100 gms
Carbonate of soda (washing soda)	2 ,,	100 ,,
Water (boiled or distilled) to...	20 ,,	1000 c.c.s.

For use, take equal parts of No. 1 and No. 2.

"Imperial" Metol Developer.

No. 1.

Metol	100 grs.	11·4 gms.
Metabisulphite of potash ...	10 ,,	1 gm.
Bromide of potassium	20 ,,	2 gms.
Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.

No. 2.

Sulphite of soda...	2 ozs.	100 gms.
Carbonate of soda	2 ,,	100 ,,
Water (boiled or distilled) to...	20 ,,	1000 c.c.s.

For use, take equal parts of No. 1 and No. 2.

Hydroquinone Developer.

No. 1.

Hydroquinone	150 grs.	16 gms.
Metabisulphite of potash ...	10 ,,	1 gm.
Bromide of potassium	50 ,,	6 gms.
Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.

No. 2.

Sulphite of soda...	2 ozs.	100 gms.
Caustic soda	100 grs.	11 ,,
Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.

For use, take equal parts of No. 1 and No. 2.

After using this developer, always rinse the negative well before transferring to the fixing bath.

SINGLE-SOLUTION DEVELOPER.

Metol	50 grs.	5·5 gms.
Hydroquinone	40 ,,	4·5 ,,
Sulphite of soda...	500 ,,	57 ,,
Bromide of potassium	25 ,,	3 ,,
Carbonate of soda	500 ,,	57 ,,
Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.

IMPERIAL P.O.P.

We specially recommend the following bath and mode of procedure for excellence and uniformity of result.

After printing, wash thoroughly for 10 to 15 minutes in running water before immersion in the toning solution.

SULPHOCYANIDE TONING BATH.

Stock Gold Solution.

Chloride of gold	15 grs.	18 gms.
Water (distilled or boiled) to...	15 drachms	1000 c.c.s.
No. 1. Sulphocyanide of ammonium...	75 grs.	8·5 gms.
Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.
No. 2. Stock gold solution	5 drachms	31 ,,
Water to	20 ozs.	1000 ,,

For use, take equal quantities of No. 1 and No. 2.
Add solution No. 2 slowly to solution No. 1, stirring all the time.
The prints should tone in 5 to 10 minutes.

IMPERIAL SELF-TONING P.O.P.

Print exactly as P.O.P. and without any washing, immerse prints in—

Sulphocyanide of ammonium ...	20 grs.	20 gms.
Powdered alum	1½ ozs.	75 ,,
Water	20 ,,	1000 c.c.s.

The temperature of this bath should not be more than about 60°. Put not more than three or four prints in the bath at a time and keep them moving about from ½ minute to 3 minutes, according to tone required—the longer the immersion the colder the tone. The bath can be used over and over again so long as it remains perfectly clear.

Wash in three or four changes of water for about 10 minutes. Fix for 10 minutes in—

Hypo	3 ozs.
Water	20 ,,

Wash for one hour in running water, or about six changes.

THE KODAK COMPANY'S FORMULÆ.

FOR KODAK FILM, KODOID FILM, AND PREMO FILM PACK.

A.	Metol	60 grs.	2 gms.
	Hydroquinone	30 ,,	3·5 ,,
	Sulphite soda (crystals) ...	1½ ozs.	75 ,,
	Water	20 ,,	1000 c.c.s.
B.	Carbonate soda (crystals) ...	1 oz.	50 gms.
	Water	20 ozs.	1000 c.c.s.

To Develop.

Take A solution 1 oz., soda solution 1 oz., water 2 ozs. Add 1 or 2 drops 10 per cent. solution potassium bromide to each oz. of developer.

Acid Fixing Bath.

Hypo	4 ozs.	500 c.c.s.
Water	16 ,,	125 gms.
Soda sulphite (cryst.)	160 grs.	10 ,,

When fully dissolved, add the following hardener—

Powdered alum	60 grs.	4 gms.
Citric acid	60 ,,	4 ,,

This bath may be made up for future use and may be used as long as it retains its strength. If plain hypo bath be used, the negatives must be rinsed in three changes of water and transferred to a saturated solution of common alum for about 5 minutes, then thoroughly washed.

PYRO FORMULÆ.

For Film-pack and Kodoids.

A.	Pyrogallic acid...	1 oz.	30 gms.
	Sulphuric acid	20 minims	1 c.c.
	Water	28 ozs.	900 c.c.s.
B.	Sulphite soda (crystals) ...	6 ,,	180 gms.
	Carbonate soda (crystals) ...	4 ,,	120 ,,
	Water	28 ,,	900 c.c.s.

To develop take A solution 1 oz., soda solution 1 oz., water 8 ozs.

FOR EASTMAN PLATES.

A.	Water	16 ozs.	1000 c.c.s.
	Potassium metabisulphite ...	60 grs.	10 gms.
	Potass bromide	5 ,,	1 gm.
	Pyro	1 oz.	75 gms.
B.	Water	16 ozs.	1000 c.c.s.
	Sodium sulphite (cryst.) ...	5 ,,	300 gms.
C.	Water	16 ,,	1000 c.c.s.
	Sodium carbonate (cryst.) ...	5 ,,	300 gms.

To develop, take of A, 1 part ; B, 1 part ; C, 1 part ; water, 7 parts.

KODAK SOLIO AND MATT SOLIO PRINTING OUT PAPERS.

Printing.—Should be done in a strong light if the negatives are hard, only thin and delicate negatives being printed in the shade. The printing should be carried only a little darker than the finished print is required, as the paper loses very little in the subsequent toning and fixing operations.

Toning.—Separate toning bath (sulphocyanide).

By adopting the following method of toning Eastman's Solio P.O.P. any desired tone may be obtained, from a red-brown to a purple-black, and the system ensures both economy in the use of gold, and great uniformity of colour throughout any number of prints. It is based on the principle of allowing a definite amount of gold to a definite number of prints or area of printed paper.

Prepare the following—

Stock Solution.

Chloride of gold	15 grs. (one tube)	1 gm.
Sulphocyanide ammonium	150 ,,	10 gms.
Water to	30 ozs.	1000 c.c.s.

The sulphocyanide should be dissolved first and the gold added afterwards. Each oz. contains ½ gr. of chloride of gold.

To impart to a 1s. packet of paper a cold purple-black tone take 6 ozs. of the stock solution and dilute with water to measure, say, 30 ozs. Treat all the prints at the same time, and allow them to remain in the bath for 8 minutes, keeping them in motion as usual in toning.

For a purple-brown colour a packet of paper requires 3 ozs. of stock solution, or for a brown colour 1½ ozs. of stock solution, whilst 1 oz. of stock solution will give a red tone.

If it is required to tone less than a packet of paper, a proportionate reduction must be made in the amount of stock solution.

The amount of water to be added to the stock solution is in all cases just as much as is considered necessary for conveniently handling the prints.

Mix the bath to the desired strength and in the desired quantity. Wash the batch of prints well for 10 minutes in running water (or in three changes of water). Transfer as rapidly as possible the whole of them, one by one, to the toning bath.

Tone for 8 or 10 minutes, moving the prints all the time.

Rinse well.

Fix for 10 minutes in the following fixing bath :—

Sodium hyposulphite	3 ozs.
Water up to...	1 pint

If the weather is warm and the surface of prints becomes soft, immerse for 5 minutes in alum bath (alum 2 ozs., water 1 pint), having given them 10 minutes to wash after fixing.

Wash for one hour in running water, or in ten changes, keeping the prints moving 2 or 3 minutes in each.

For those who prefer a combined toning and fixing bath we give the following formula :—

The tones obtainable are from red to dark brown.

Printing must be carried decidedly darker than the finished pictures should appear.

A. Hypo	6 ozs.	200 gms.
Ammonium sulphocyanide	48 grs.	4 „
Water	32 ozs.	1000 c.c.s.
B. Gold chloride	15 grs. (1 tube)	1 gm.
Lead acetate	150 „	10 gms.
Water	16 ozs.	500 c.c.s.

Take 7 parts of A to 1 part of B. Print decidedly darker than for ordinary bath. Wash thoroughly and tone in this bath.

Caution.—The combined toning and fixing baths should not be used for postcards and other thick papers. They should be toned in the separate bath, then very thoroughly fixed and washed for one and a half hour in running water, or fifteen changes.

Matt Solio Paper.

All the foregoing directions apply also to the treatment of Matt Solio, but the toning bath which we specially recommend for Matt Solio is the following:—

Sepia Tones—Stock Solution.

Potassium chloroplatinite ...	5 grs.	1 gm.
Citric acid	40 „	8 gms.
Sodium chloride (salt)	40 „	8 „
Water	20 ozs.	1000 c.c.s.

This bath keeps well for a month.

Wash the prints from 5 to 10 minutes, and then immerse in the above bath, examining the prints by transmitted light.

Tone to a dark brown or chocolate colour (not black), rinse slightly, and immerse the prints in the following bath to stop the toning action:—

Sodium carbonate (washing soda)	½ oz.	15 gms.
Water	20 ozs.	600 c.c.s.

Rinse and transfer to the following fixing bath:—

Sodium hyposulphite	3 ozs.	150 gms.
Water	20 „	1000 c.c.s.

Wash thoroughly in running water or by frequent changes for one hour.

Should it be thought desirable to specially harden the gelatines, use an alum bath as follows:—After fixing the prints, wash them well from 10 to 15 minutes, and then immerse for not more than 5 minutes in—

Alum	½ oz.	15 gms.
Water	20 ozs.	1000 c.c.s.

and finally wash thoroughly.

Rapid Printing Process, by Development, of Solio.

Print until the image shows distinct detail in all but the high lights,

Developer.—Develop with the following developer until the prints look similar to printed out prints, but rather more brown in colour; this should take 5 or 6 minutes.

Hydroquinone	26 grs.	2 gms.
Citric acid	60 ,,	5 ,,
Acetate soda	1½ oz.	50 ,,
Water	30 ozs.	1000 c.c.s.

As soon as the prints are dark enough transfer them to a dish containing plenty of clear water (running water if possible), and allow them to wash for about 15 minutes. The prints will continue to develop very slightly when first transferred to the washing water, and for this reason care should be taken not to develop them too dark. Then tone in the sulphocyanide or combined toning and fixing bath in the usual way.

A little extra care should be exercised in putting Solio intended for development into the frames, and taking it therefrom. It should be done in subdued daylight. Development is best done by ordinary lamplight without a yellow shade. Prints made by this process are even more brilliant, and show more detail than those fully printed out.

Kodak Self-Toning Solio Paper (Matt and Glossy).

Print slightly deeper than the finished print is required.

Put the prints, without previous washing, into the following bath, and keep them moving for 3 to 5 minutes:—

Ammonium sulphocyanide ...	20 grs.	2 gms.
Water	20 ozs.	1000 c.c.s.

Wash for 5 minutes in running water, or several changes, and fix in—

Hypo	3 ozs.	150 gms.
Water	20 ozs.	1000 c.c.s.

for 10 minutes. Then wash in running water for one hour, or in fifteen to sixteen changes.

The following alternative bath will give good warm tones on both grades of paper, but is specially recommended for Matt. Put the prints, without previous washing, into the following bath:—

Salt	1 oz.	50 gms.
Water	20 ,,	1000 c.c.s.

for 5 minutes, and then place in the above fixing bath.

Kodak Collodio Chloride Paper.

Directions.

Matt.

The printing of matt collodio-chloride for platinum tones should be very deep, and, as a general thing, it should be printed without vignetting. Print until the high lights are well tinted. Pay no attention to the shadows, no matter how much they bronze, as that will all tone out. Prints should be washed in six changes of clear water, moving them about in each change; unless the prints are thoroughly washed they will not tone evenly. When the prints are

sufficiently washed and ready to tone, they are first placed in a plain gold bath, made alkaline with borax, enough to turn red litmus paper blue in one minute.

Gold chloride	1 gr.
Water	30 ozs.

Add sufficient of a saturated solution of borax to make bath very slightly alkaline (about 25 to 30 drops)

Tone in this bath to chocolate brown in the deepest shadows by transmitted light. The gold toning bath should be made up from 4 to 5 hours before use. Add gold enough to keep the speed of the bath 6 to 8 minutes. If the prints show bleaching in the half-tones before the shadows are toned far enough, add more borax. The alkali acts as a restrainer on the half-tones. The amount to use is the amount necessary to hold the half-tones from bleaching while the shadows tone. When the prints are toned, place in clear water ; and when all are toned, wash in three changes of water and tone in the following platinum bath :—

Potassium chloroplatinite...	4 grs.
Citric acid	100 ,,
Water	30 ozs.

This bath should be made up an hour before use, and, in cold weather or when the water used is cold, the chill should be taken off the bath with a little warm water. The prints should be toned in this bath until all trace of red or brown is out of the deepest shadows. When prints are toned in the platinum bath, place in clear water, and when all are toned wash in three changes of water, moving them about by hand in each. After prints are washed, fix in hyposulphite of soda bath, 1 oz. of crystals to 16 ozs. of water, for 15 minutes, moving the prints while fixing. After prints are fixed, wash from an hour to an hour and a half in running water, or 10 to 12 changes, by hand.

Glossy.

Printing.—Print considerably darker than desired when finished and after washing tone in the following bath :—Water 60 ozs., kodak gold solution 2 drachms (or, if dry chloride of gold is used, 2 grains) and ½ drachm of dry acetate of soda. Add a few drops of saturated solution of borax, enough to make the bath slightly alkaline. Allow to stand 2 or 3 hours before using. It is a good plan to save this bath from day to day and use part old and part new each time. If the prints fail to clear up, leaving muddy half-tones, too much alkali has been used. If the prints bleach and turn blue in the half-tones, while the shadows remain red, not enough alkali has been used.

For Dark Tones.—We submit the following bath for those desiring deep blue or black tones. This bath can be renewed two or three times by the addition of gold.

Water	32 ozs.
Sulphocyanide of ammonium	½ oz.
Gold chloride	2 grs.

Fixing.—Fix in hypo bath, 1 oz. hypo to every 16 ozs. of water. Have plenty of bath to cover prints nicely, and separate thoroughly. 15 or 20 minutes will be sufficient time.

Final Washing.—Finally, wash thoroughly. It is the frequent and complete change of water that washes the hypo from a print, not continuous soaking. One hour in running water that changes completely every few minutes is sufficient, or seven or eight changes of water if prints are washed by hand.

Aristo Self-toning Papers.

For Warm Tones.

Print slightly deeper than required in the finished print, wash in two changes of fresh water, and fix in:—

Hyposulphite of soda	5 ozs.
Water	40 ,,

made slightly alkaline by the addition of three drops of liquid ammonia.

Fix prints 15 minutes and place for 10 minutes in following salt bath:—

Common salt	8 ozs.
Water	1 gall.

Wash in eight to ten changes of water and mount.

For Cold Tones.

Place prints in 60 ozs. of water to which 1 oz. of table salt has been added. Allow the prints to remain in the salt bath for about five minutes.

After the salt bath, transfer prints to a tray of clear water. When all are finished, put them directly into the fixing bath given above and from it to the 8 oz. per gallon salt bath, finally washing in plain water.

Kodak Bromide Papers, Permanent, Platino-Matt, Royal, White Royal, Nikko and Velvet.

Metol-Hydroquinone Developer.

Metol	8 grs.	·9 gm.
Hydroquinone	30 ,,	3·5 gms.
Sodium sulphite (cryst.) ...	¾ oz.	36 ,,
Sodium carbonate (cryst.) ...	¾ ,,	36 ,,
10% solution of potassium bromide	20 minims	2 c.c.s.
Water	20 ozs.	1000 ,,

Amidol Developer.

Amidol	60 grs.	1·8 gm.
Sodium sulphite (cryst.) ...	1 oz.	50 gms.
10% solution potassium bromide	20 drops	2 c.c.s.
Water	20 ozs.	1000 ,,

This bath should only be made up immediately before use.

After exposure the paper should be soaked for a minute in water, and then flooded with the developer. The picture will appear almost immediately. When sufficiently developed the print should be

washed in 3 or 4 changes of water, and then immersed for 10 minutes in the following fixing bath :—

Sodium hyposulphite	4 ozs.	200 gms.
Water	20 ,,	1000 ,,

After fixing, wash thoroughly in several changes of water for two hours at least, and hang up to dry.

Sepia Toning Formula.

Sodium hyposulphite	10 ozs.
Alum	1 oz.
Boiling water	70 ozs.

Dissolve the hypo in the water, and then add the alum slowly. When all is dissolved the solution should be milk white. This solution should not be filtered, and it works better as it becomes older ; it may be strengthened from time to time with a little fresh solution. Never throw the bath away entirely, but replenish it in the manner stated. The best results are obtained on prints developed by the above amidol formula, and by keeping the bath hot, or as warm as the emulsion will stand, say 100 to 120 degrees F. In this bath prints will tone in 30 to 40 minutes.

Alum Bath.

When this toning bath is to be employed, the use of the alum bath after fixing is absolutely essential. Moreover, the prints should not, in this case, be subjected to a prolonged washing, but should only be slightly rinsed before being dried. A new bath tends to reduce the prints rather more than an older one. When toned, the prints should be placed in a tepid solution of—

Water	70 ozs.
Alum	2 ,,

then washed thoroughly.

KODAK DEKKO PAPER.

The metol-hydroquinone developer given above for Kodak bromide papers will be found to work well if the chemicals are dissolved *in* 10 *instead of* 20 *ozs. of water*. It is of the utmost importance that the developer should contain the full amount of bromide, for without it the paper will not produce clear whites.

When developed, rinse quickly and immerse in the following fixing bath :—

Hyposulphite of soda	4 ozs.	120 gms.
Alum	1 oz.	30 ,,
Water	16 ozs.	450 c.c.s.

Fix for 15 minutes, keeping the prints separated. When fixed, transfer to the washing tray.

KODAK PLATINUM PAPER.

Directions.

Developing.—The developer is simply neutral potassium oxalate and water ; 2 ozs. of neutral patassium oxalate dissolved in 10 fluid ozs. of water. If tones more on the blue black are desired, use the following developer :—water, 10 ozs. ; potassium oxalate, 1 oz. ;

potassium phosphate, ½ oz. In preparing developer containing potassium phosphate, always use warm water, as this chemical does not dissolve freely in cold water.

Clearing Bath.—As soon as prints are fully developed they are placed faced down directly into a clearing bath of hydrochloric acid and water; 1 oz. of pure hydrochloric acid to 60 ozs. of water.

LETO PHOTO-MATERIALS CO., LTD.

Seltona Self-toning Paper.

Directions for Use.

FOR WARM BROWN TONES.

Soak the prints for a minute or two in clean water, and place in the fixing bath as follows :—

Hypo	2 ozs.	100 gms.
Water	20 ,,	1000 c.c.s.

Fix for about 10 minutes, then wash for 1 hour in running water or 8 to 10 changes.

DARK BROWN, PURPLE AND BLUE TONES.

Soak the prints for a minute or two in clean water, and place for 7 to 10 minutes in the following :—

Common salt	1 oz.
Water...	12 ozs.

or 4 good tea-spoonfuls to ½ pint water).

A stronger solution may be employed if desired.

Rinse in clean water and fix as above.

Darker and Bluer Tones are obtained by placing the prints *direct* into the salt solution without previous washing.

A stronger solution of salt up to 2 ozs. in 10 ozs. may be employed if desired.

Leto Platino-Matt.

FOR BROWN-BLACK AND WARM-BLACK TONES.

Printing.—Print very deeply, until the shadows develop a distinct bronze tinge, as the prints lose considerably during the toning process.

Washing.—It is most important that this should be done thoroughly. Wash in several changes until the last washing water is perfectly clear.

Toning.—The prints are first partly toned in the following gold bath. Toning must not be carried on too far, but only until the prints seem to have changed colour. A long immersion will yield blue-black and a short immersion brown-black tones in the subsequent platinum bath.

Shortly before use only, make up as follows :—

Water	17 ozs.	530	c.c.s.
Acetate of soda	1 oz.	30	gms.
Gold chloride	1 gr.	·065	,,

After toning, wash for a minute or two, and continue in the following platinum bath, until the desired effect has been obtained. (This bath may be used over and over again until exhausted, when a fresh bath must be made up.)

Water	9 ozs.	250 c.c.s.
Phosphoric acid...	2 drachms	7·1 ,,
Chloroplatinite of potash ...	7½ grs.	·48 gms.

Then wash in 2 to 3 changes of water.

Fixing.—Fix for 10 minutes in hypo 1 oz.; water 20 ozs. with ittle soda bicarbonate in it.

Final Washing.—For at least 1 hour in running water or 8 to 10 changes.

Drying.—Damp off the moisture between clean blotting-paper and allow the prints to dry spontaneously, or they may be dried before the fire.

Rich Sepia and Red-Brown Tones.

Rich sepia and red-brown tones are obtained by diluting the above solutions with an equal quantity of water, and proceeding in the same way as for black tones.

Toning in the gold bath must only be carried on until the high lights are clear.

In the platinum bath the prints must only be immersed for a few moments and then fixed as usual.

Dark Sepia tones can be obtained by using the platinum bath as given above, without the gold bath, but 10 to 12 ozs. of water should be taken in place of the 9 ozs.

Printing must not be carried on too far.

Excellent tones are obtainable with any of the well-known formulæ for P.O.P.'s, such as the sulphocyanide, acetate or borax baths.

Leto-Gaslight Paper.

Developers.

Adurol.

For Brown-Black Tones.

Adurol-Schering	¼ oz.
Soda sulphite, cryst.	2 ozs.
Water	12½ ,,
Soda carbonate	1½ oz.
Water	12½ ozs

Shortly before use mix equal parts of each.

Metol-Hydroquinone.

For Pure Black Tones.

Water	10 ozs.
Soda carbonate	1½ oz.
Soda sulphite, cryst.	¼ ,,
Metol	10 grs.
Hydroquinone	30 ,,
Pot. bromide (10% solution)	4 minims

For correct exposure development should be complete in 10 to 30 seconds.

It is advisable to give plenty of exposure and develop quickly. When fully developed rinse and fix in an acid fixing bath for about 10 minutes and wash for 1 hour in several changes or running water.

"Juno" Collodion P.O.P.

Toning Bath.

Water	20 ozs.	1000 c.c s.
Ammon. sulphocyanide ...	90 grs.	9 gms.
Gold chloride	3 „	·3 gm.

Fix for at least fifteen minutes in:—

Hypo. ... ... 1 oz. | Water ... ... 15 ozs.

The Leto-Juno Paper can also be toned in any of the usual formulæ for the combined toning and fixing of ordinary P.O.P. The prints (as a rule) are immersed direct into the solution without previous washing. Care must be taken that the solution is not too warm otherwise the prints will be toned before they are fixed.

"Pluto" Collodio-chloride Paper.

Platinum Toning Bath.

Water	20 ozs.	1000 c.c.s.
Citric acid	90 grs.	9 gms.
Potass. chloro-platinite ...	3 „	·3 gm.

It may be more convenient to make up the following stock solutions:—

A	Acid citric	1 oz.
	Water	2½ ozs.
B	Potass. chloroplatinite	15 grs.
	Water, distilled...	2½ ozs.

For use, take—

Stock solution A	2 drs.
Stock solution B	2 „
Water...	10 ozs.

Let stand ten minutes before use.

Brown Tones.—Do not print so deeply as for black tones. Wash in four changes of *lukewarm* water and immerse in a very weak ammonia bath (say ¼ oz. to 40 ozs. water) until they turn a uniform lemon yellow. Wash out the ammonia from the prints in at *least* six changes of water and tone in the above platinum bath and fix as usual. (It is important that the prints be free from ammonia to avoid staining in the platinum bath.)

Excellent warm sepia tones are obtained by first washing the prints as usual and placing direct into the fixing bath (hyposulphite of soda, 1 oz., water, 15 ozs.). Fix for fifteen minutes and wash for 1 to 1½ hours in several changes. Printing must not be carried on so far as for warm black tones.

LUMIERE'S FORMULÆ.

Pyro Developer.

No. 1.

Water	15 ozs.	300 c.c.s.
Pyro	1 oz.	20 gms.
Soda sulphite	3 ozs.	60 ,,
Nitric acid	30 minims	1.4 c.c.s.

No. 2.

Water	15 ozs.	300 c.c.s.
Soda carbonate	4 ,,	75 gms.
Soda sulphite	3 ,,	60 ,,

For use take

Water	1 oz.	60 parts
No. 1 solution	1 drachm	6 ,,
No. 2 solution	1—1½ drachms	6—10 ,,

Dianol (Diamidophenol).

Water	1000 c.c.s.
Anhydrous s da sulphite	30 gms.
Dianol	5 ,,

This solution should be used quite fresh.

A stock solution of the soda sulphite and water may be made and the dianol added dry in proportionate quantity at time of using.

Lumiere's Citrate P.O.P.

Glossy and Matt (Mauve).

Any of the ordinary toning methods may be employed, but the makers specially recommend the use of the following combined toning and fixing bath, the results obtained with which cannot be beaten for beauty or permanence.

A. Warm water	20 ozs.	1000 c.c.s.
Hyposulphite of soda	7 ,,	400 gms.
Alum	170 grs.	20 ,,
Lead acetate	17 ,,	2 ,,
Citric acid	17 ,,	2 ,,

Dissolve the hyposulphite, citric acid, and alum, and when cold add the lead acetate. Allow to stand for several hours, and then filter carefully.

B. Water	3½ ozs.	100 c.c.s.
Gold chloride	15 grs.	1 gm.

To 100 parts of A add from 6 to 8 parts of B, according to tone required.

Printing should be carried on till about one-third darker than ordinary albumen paper.

Before toning wash for 10 minutes in frequently changed water.

Afterwards wash for 2 hours in several changes of water.

For those who prefer the separate baths we give the following formula :—

Distilled water	20 ozs.	1000 c.c.s.
Refined chalk	45 grs.	5 gms.
1 per cent. solution of gold chloride	2 ,,	100 c.c.s.

Allow to stand for 24 hours, then filter, and for use add 15 parts of above bath to 100 parts of water.

After toning, rinse prints and transfer to a 1 per cent. solution of alum for a few minutes, wash well, and fix in :—

Fixing Bath.

Water	20 ozs.	1000 c.c.s.
Hyposulphite of soda	3 ,,	150 gms.
Soda bisulphite	1½ drachms	6 ,,
Alum	30 grs.	4 ,,
1 per cent. solution of lead nitrate	2 drachms	15 c.c.s.

In this bath the prints will turn to a yellowish red, but will then change rapidly through brown to blue. Take the prints from the bath when the desired tone is obtained, and wash, preferably in running water.

For use with the matt paper, the following platinum bath will be found to produce tones of great beauty—

Water	20 ozs.	500 c.c.s.
Salt	30 grs.	2 gms.
Potass chloroplatinite	15 ,,	1 gm.

First wash for 10 minutes, then tone till the print appears black, wash in several changes of water, and fix in the combined toning and fixing bath before given.

To obtain platinum black tones, add to the platinum bath a few minims of a 1 per cent. solution of gold chloride.

Lumiere's Self-Developing "Takis" Paper.

The print develops in water, and is fixed in : hypo, 3 ozs. ; water, 20 ozs. This treatment gives sepia and brown tones.

For tones from brown to purple, fixing is done in a combined toning and fixing bath made as follows :—

A. Boiling water	40 ozs.	1000	c.c.s.
Hypo	10 ,,	280	gms.
Alum	¾ oz.	21	,,
Lead acetate	35 grs.	2·3	,,
B. Water	15 drachms.	60	c.c.s.
Gold chloride	15 grs.	1	gm.

Dissolve the hypo and alum in the boiling water, and when cold add the lead acetate, previously dissolved in a little distilled water. It is advisable to prepare 24 hours before using and filter if necessary.

For use.—Add to 10 ozs. of "A" 2 to 3 drachms "P."

Black tones may be obtained by first toning in the following platinum bath :—

Water	35 ozs.	1000 c.c.s.
Citric acid	150 grs.	9·6 grs.
Potass chloroplatinite	15 ,,	1 gm.

followed by fixation in the toning and fixing bath above given.

Lumiere's Bromide Papers.

FOR CONTACT PRINTING.

The developer most recommended is as follows :—

Water	20 ozs.	1000 c.c.s.
Anhydrous soda sulphite ...	170 grs.	20 gms.
Dianol	45 ,,	5 ,,
10% solution of pot. bromide	20—50 minims	2—5 c.c.s.

This developer should be freshly made for each batch of prints, but should it be desired, the soda solution can be made in bulk, and the diamidophenol added at the time of use.

Fixing and Washing.—The prints, when removed from the developer, should be well rinsed and then fixed for 5 or 6 minutes in the following :—

Fixing Bath.

Water	1000 parts.
Hyposulphite of soda	200 ,,
Soda bisulphite	100 ,,
Alum	2 ,,

After fixing, wash prints thoroughly and hang up to dry.

MARION'S FORMULÆ.

DEVELOPERS FOR "MARION" PLATES.

For portraiture the following is recommended :—

PYRO STOCK SOLUTION.

Pyrogallic acid	1 oz.	50 gms.
Sodium sulphite	8 ozs.	400 ,,
Sulphuric acid	6 grs.	·6 ,,
Water to make up	20 ozs.	1000 ,,

SODA STOCK SOLUTION.

Sodium carbonate (cryst.) ...	8 ozs.	400 gms.
Potassium bromide	6 grs.	·6 ,,
Water to make up	20 ozs.	1000 c.c.s.

For Development.

Five ozs. (250 c.c.s.) of each stock solution made up separately to 20 ozs. (1000 c.c.s.) with water and mixed in equal parts at the time of using. When very soft negatives are required—or only a minimum of exposure can be given—the bromide of potassium may be omitted.

Pyro-Ammonia.

Pyrogallic acid	1 oz.	100 gms.
Ammonium bromide	1 ,,	100 ,,
Citric acid	6 grs.	1·2 ,,
Water to make up	10 ozs.	1000 c.c.s.

Ammonia.

Strongest liquid ammonia (·880)	1½ oz.	150 c.c.s.
Water to make up	10 ozs.	1000 c.c.s.

Two ozs. (200 c.c.s.) of each of above separately made with water to 20 ozs. (1000 c.c.s.) form the solutions for use, equal parts being mixed together at the time of development.

Metol and Hydroquinone.

Metol	50 grs.	6 gms.
Hydroquinone	50 ,,	6 ,,
Sodium sulphite	700 ,,	80 ,,
Potassium bromide	5 ,,	1 gm.
Citric acid	5 ,,	1 ,,
Water to	20 ozs.	1000 c.c.s.
Potass carbonate	2 ,,	100 gms.
Water to	20 ,,	1000 c.c.s.

Equal parts being mixed at time of use.

For Gelatino-Chloride Plates.

Iron.

For Cold Tones.

No. 1. Potass citrate	100 grs.	230 gms.
Potass oxalate	30 ,,	69 ,,
Hot distilled water to make up to	1 oz.	1000 c.c.s.

For Warm Tones.

No. 2. Citric acid	90 grs.	206 gms.
Ammonium carbonate	60 ,,	137 ,,
Cold distilled water to make up to	1 oz.	1000 c.c.s.

For Extra Warm Tones.

No. 3. Citric acid	130 grs.	297 gms.
Ammonium carbonate	40 ,,	92 ,,
Cold distilled water to make up to	1 oz.	1000 c c s

In mixing the solutions Nos. 2 and 3, it is better to place the crystals of the salts into a deep vessel, and, after adding the water, leave alone till all effervescence ceases. It is advisable to make it over night.

To three parts of either of the above add one part of the following at the time of using :—

Sulphate of iron	120 grs.	275 gms.
Sulphuric acid	1 drop	2 c.c.s.
Make up with distilled water to	1 oz.	1000 c.c.s.

Either of these developers should give clear glass in the unexposed parts of the picture ; but, if at any time the slightest fog is found, it should at once be cured by the addition of a trace of either potassium bromide or sodium chloride. Bromide is better with No. 1, and chloride with either No. 2 or No. 3. A convenient form of using these will be to keep a 10 per cent. solution of each of these salts, and 1 or 2 minims to each ounce of developer will be found a powerful restrainer.

Hydroquinone.

No. 1. Hydroquinone	...	48 grs.	11 gms.
Sodium sulphite ...	...	320 ,,	73 ,,
Ammonium bromide ...	...	2 ,,	0·5 gm.
Water to make up to ...	...	10 oz.	10·0 c.c.s.
No. 2. Ammonium carbonate...	...	100 grs.	23 gms.
Sodium carbonate ...	...	100 ,,	23 ,,
Water to make up to ...	...	10 ozs.	1000 c.c.s.

Equal proportions of each are mixed together, according to size of plate to be developed at the time of using.

Different alkalies may be substituted for those mentioned, such as potassium carbonate, sodium silicate, potassium hydrate, sodium hydrate, etc. ; but, in all cases, a small proportion of bromide should be used.

A number of plates may be developed one after the other in the same solution.

Mariona Paper (P.O.P.).

Directions.—Print as with albumenised papers, slightly darker than required for the finished picture, or for partial development, as instructions below.

Washing.—After printing, wash thoroughly in several changes of water from 10 to 15 minutes.

Toning.—This paper may be toned with any of the usual baths, but the following are recommended :—

Platinum Toning.—For Sepia Tones on Matt Paper.

Stock Solutions.

A. Potassium chloroplatinite, 15 grs. (2·3 gms.) in 15 ozs. (1000 c.c.s.) of water, to which have been previously added 5 minims ($\frac{1}{2}$ c.c.) of hydrochloric acid.

B. Citric acid	160 grs.	46 gms.
Chloride sodium	160 ,,	46 ,,
Water	8 ozs.	1000 c.c.s.

Take equal parts of A and B, and dilute with water to 4 or 6 times the bulk, according to speed of toning desired

Gold Toning.—For Glossy Paper.

A. Stock solution of gold chloride, 15 gr. tube in 15 ozs. of water (2·3 gms. per litre).

B. Sodium carbonate (common washing soda), 30 grs. in 15 ozs. of water (4½ gms. per litre).

Take according to requirements equal parts of A and B, and dilute with water, to 4 or 6 times the bulk according to speed of toning desired.

Gold Toning.—For Both Papers.

A. Stock solution of gold chloride, 15 grs. in 15 ozs. of water (2·3 gms. per litre).

B. Stock solution of ammonium sulphocyanide containing 10 grs. to every oz. of water (35 gms. per litre).

For use, take 1 part of each and make up with water, to 8 or 12 times the bulk. The bath should be fresh every time.

Partial Development.—This method will be found very convenient in dull weather, or even at night by magnesium or electric light. Print till the image is fairly visible, then immerse without washing in a 10 per cent. solution of potassium bromide for 4 or 5 minutes. Then, after washing for a few minutes, place the print in the following developer mixed in equal proportions :—

A. Hydroquinone	80 grs.	9 gms.
Sodium sulphite	320 ,,	37 ,,
Make up with distilled water to	20 ozs.	1000 c.c.s.
B. Sodium carbonate	400 grs.	460 gms.
Ammonium carbonate... ...	400 ,,	460 ,,
Ammonium bromide	40 ,,	46 ,,
Make up with distilled water to	2 ozs.	1000 c.c.s.

Continue the development until all but the faintest details are visible, then immediately wash the print thoroughly in running water to remove entirely the developer before placing it in the toning bath. All after-treatment will be the same as given above for printed-out prints.

Marion's Self-Toning Paper.

Print as usual only slightly darker than required for finished picture, then place in following fixing bath for from 7 to 15 minutes according to tone required, bearing in mind that after drying, the colour becomes rather colder and darker.

The fixing bath is 4 ozs. hyposulphite soda made up with water to one pint.

For sepia and warm tones add to the fixing bath about 1 drachm of washing soda to each pint.

MARION'S "QUICK PRINT" PAPER.

Expose to diffused daylight for from one to ten seconds, or to, say, 1 inch of magnesium burnt 12 inches from the negative.

Amidol Developer.

Soda sulphite (pure cryst.) ...	200 grs.	46 gms.
Amidol	20 ,,	4.6 ,,
Potass bromide (10% solution)	10 drops	35 drops
Water	10 ozs.	1000 c.c.s.

Adurol Developer for Cold Tones.

Adurol	20 grs.	4.6 gms.
Soda carbonate	200 ,,	46 ,,
Soda sulphite	200 ,,	46 ,,
Potass bromide	5 ,,	1 gm.
Water to...	10 ozs.	1000 c.c.s.

Time of exposure with average negative, one inch magnesium ribbon burnt at one foot distant. Time of development, one minute.

Developer for Warm Tones.

Adurol	20 grs.	2.3 gms.
Soda carbonate	200 ,,	23 ,,
Sodium sulphite	200 ,,	23 ,,
Potass bromide	25 ,,	3 ,,
Water to...	20 ozs.	1000 c.c.s.

Time of exposure with average negative, six inches magnesium ribbon burnt to one foot distant. Time of development, four minutes.

Should the prints show a lack of purity in the whites, add to the developer a few drops more of 10 per cent. bromide solution.

MARION'S BROMIDE PAPER.

Amidol Developer.

(One-solution.)

Amidol	40 grs.	4·6 gms.
Sodium sulphite	400 ,,	46 ,,
Potass bromide	5 ,,	·8 gm.
Water to make up to	20 ozs.	1000 c.c.s.

MARION'S COLLODIO-CHLORIDE PAPER.

For Warm Black Tones—Platinum Toning Bath.

Potassium chloroplatinite ...	15 grs.	1 gm.
Phosphoric acid (s.g. 1·120) ...	2½ drachms	9 c.c.s.
Water	35 ozs.	1000 ,,

Remove prints as soon as they are of desired tone, which will be in from two to six minutes, according to age of bath. Wash well before fixing.

Blue-Black Tones—Gold Toning Bath.

Chloride of gold	2 grs.	·13 gm.
Borax	80 ,,	5 gms.
Water	25 ozs.	700 c.c.s.

Make up two hours before use.

Keep prints in this bath until they assume a purple tone, then wash in several changes of water and transfer to platinum bath (given above). Remove when they reach a rich black. If prints do not remain long enough in platinum bath they will be blue-black with impure half tones.

Wash after toning for half an hour in five or six changes of water, then fix.

Fixing Bath.

Hypo	1 oz.
Water...	20 ozs.

Fix for 10 to 15 minutes.

Sepia Tones

Wash prints in five or six changes of luke-warm water, to the last three of which add 1 per cent. of liquid ammonia ·880 (not stronger or blisters will be produced). When lemon-yellow wash in five or six changes of water and tone in the platinum bath. Wash and fix as usual.

Red Carbon Tones.

Wash prints in three changes of water, then place in a bath of—

Common salt	1 tea-spoonful
Water	40 ozs.

As soon as they become yellow remove, rinse in water, and place in the borax gold bath. Just as they are reaching tone desired again place them in salt bath to stop further toning, and, after rinsing in water, fix as usual,

Brown and Dark Blue Tones.

Print dark, and treat as for red carbon tones, but tone in platinum bath only.

Purple Tones.

Print very dark. Wash in three changes of water and place in the following bath:—

Gold chloride (1% solution) ...	1 oz.	10 c.c.s.
Acid hydrochloric pure ...	3 ozs.	30 ,,
Water	10 ,,	100 ,,

Less acid gives a blue tone. More acid gives a purple tone. Tone until desired colour is obtained. Wash and fix as usual.

MARION'S S. D. PAPER
(Simple Development.)

The exposure is about 30 seconds to ordinary gas flame at distance of 6 inches.

The simple developing solution is 2 ozs. soda carbonate crystal (or ordinary washing soda) in 1 pint of water. The image appears very quickly and is fully developed in from 15 to 30 seconds. Rinse well and place in acid fixing bath.

MATTOS FORMULÆ.

Prints vigorously, more so for blacks than for reds, until full details are complete in the whites. Wash thoroughly, changing the water frequently, until it runs off clear.

Gold Bath.

For reds, browns, sepias and blacks.

Stock Solutions.

A.	Borax refined	180 grs.	12 gms.
	Sodium acetate	180 ,,	12 ,,
	Citric acid	15 ,,	1 gm.
	Water	35 ozs.	1000 c.c.s.
B.	Gold chloride	15 grs.	1 gm.
	Water	35 ozs.	1000 c.c.s.

Immediately before use, mix 10 parts of A and 3 parts of B.

To obtain red or brown tints, withdraw the proof from the bath, when the whites begin to be degraded, which should be terminated in 20 to 40 seconds.

After toning, wash quickly in several changes of water.

Fix for 10—15 minutes in a bath containing 2 ounces hypo. in 25 ounces of water. Wash thoroughly as usual.

Platinum Bath for Brown Blacks.

Citric acid	90 grs.	6 gms.
Potassium chloroplatinite ...	15 ,,	1 gm.
Water	20 ozs.	600 c.c.s.

For Cold Blacks.

Tone first in the gold bath until the whites are slightly pink, then in platinum.

After toning, immerse the print for about 30 seconds to neutralise the acid in the following solution :—

Bicarbonate of soda	½ oz.	8 gms.
Water	20 ozs.	600 c.c.s.

Fix for 10 to 15 minutes in

Hypo.	2 ozs.	50 gms.
Water...	20 ,,	500 c.c.s.

Wash thoroughly, changing the water 10 to 15 times at intervals of five minutes.

Fine browns are obtained by simply fixing the print in the following bath :—

Hyposulphite of soda	2½ ozs.	50 gms.
Carbonate of soda	½ oz.	10 ,,
Water	25 ozs.	500 c.c.s.

Sepias with Platinum.

Wash the print as usual, then plunge it for about 15 seconds into a solution of

Ammonia, sp. gr. ·880	1 oz.	28 c.c.s.
Water	20 ozs.	600 c.c.s.

Then tone in the platinum bath, fix and wash as recommended.

Wood, linen, silk and satin are all treated in the same manner as the papers, except wood, which must be fixed for at least half-an-hour.

MAWSON & SWAN'S FORMULÆ.

THE "MAWSON," "FELIXI," "CELERITAS," "ELECTRIC," AND "CASTLE" PLATES.

DEVELOPERS.

Pyro-Ammonia Developer.

Stock Solution (10 per cent.)

Pyrogallic acid	480 grs.	110 gms.
Bromide of ammonium ...	240 ,,	55 ,,
Metabisulphite of potassium...	480 ,,	110 ,,
Distilled water to make up (fl.)	10 ozs.	1000 c.c.s.

Dissolve the metabisulphite in part of the water, then add the other ingredients, and make up to bulk with water.

A. Stock solution	300 minims	62 c.c.s.
Distilled water to make up to (fl.)	10 ozs.	1000 ,,
B. Liquid ammonia (·880) ...	70 minims	14·5 ,,
Distilled water to make up to (fl.)	10 ozs.	1000 ,,

Use equal parts of A and B mixed at time of developing.

2.—*Pyro-Soda Developer.*

Stock Solution.

Pyrogallic acid	480 grs.	110 gms.
Metabisulphite of potassium...	120 ,,	28 ,,
Distilled water to make ...	10 ozs.	1000 c.c.s.

Dissolve the metabisulphite before adding the other ingredients.

A. Stock solution	600 minims	125 c.c.s.
Distilled water to make ..	10 ozs.	1000 ,,
B. Carbonate of soda (cryst.) ...	480 grs.	110 gms.
Sulphite of soda	640 ,,	146 ,,
Distilled water to make ...	10 ozs.	1000 c.c.s.

Use equal parts of A and B.

Developers for Mawson "Ortho A" and "Ortho B" Plates.

Pyro-soda.

The above formula, with the addition of 40 grs. (9 gms.) potass bromide to the stock solution, gives excellent results.

To Correct Errors in Exposure.—If under-exposed, use a larger proportion of B; if over-exposed, decrease the proportion of B, and add a few drops of a 10 per cent. solution of bromide of potass.

Amidol Developer.

Amidol	... 100 grs.	23 gms.
Sulphite of soda ...	...1000 ,,	228 ,,
Bromide of potass ...	... 10 ,,	2·3 ,,
Distilled water to make to ...	10 ozs. (fl.)	1000 c.c.s.

Use 1 part to 3 parts water.

The Mawson Photo-mechanical Plate.

Developers.

Pyro-Ammonia Developer.

A. Pyrogallic acid	30 grs.	7 gms.
Bromide of ammonium... ...	30 ,,	7 ,,
Metabisulphite of potassium ...	30 ,,	7 ,,
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.
B. Liq. ammoniæ (·880)	70 minims	14·5 ,,
Distilled water to make up to (fl.)	10 ozs.	1000 ,,

Use equal parts of A and B mixed at time of developing.

Hydroquinone Developer.

A. Hydroquinone	40 grs.	9 gms.
Bromide of potassium	10 ,,	2 ,,
Metabisulphite of potassium...	40 ,,	9 ,,
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.
B. Caustic potass (sticks)... ...	80 grs.	18 gms.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

Use equal parts of A and B mixed at time of developing.

The Mawson Lantern Plate.

Developers.

Exposure.—A negative of average density requires about 15 seconds at 1 foot from a No. 6 bat's-wing burner. Short exposure tends to produce black tones; long exposure, brown tones.

Either of the following developers may be used, though we give the preference to the pyro-ammonia, greater variety of tone being available by it.

Development begins rather slowly, especially with the hydroquinone formula, afterwards proceeding more rapidly.

Pyro-Ammonia Developer.

A.	Pyrogallic acid	20 grs.	4·5 gms.
	Bromide of ammonia	20 ,,	4·5 ,,
	Metabisulphite of potassium...	50 ,,	11·5 ,,
	Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.
B.	Liq. ammoniæ (·880)	70 minims	15 c.c.s.
	Distilled water to make up to (fl.)	10 ozs.	1000 ,,

Use equal parts of A and B mixed at time of developing.

Hydroquinone Developer.

A.	Hydroquinone	40 grs.	9 gms.
	Bromide of potassium... ...	40 ,,	9 ,,
	Metabisulphite of potassium...	40 ,,	9 ,,
	Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.
B.	Caustic potass (sticks) ...	80 grs.	18 gms.
	Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

Use equal parts of A and B mixed at time of developing.

CLEARING SOLUTION.

Hydrochloric acid	½ oz. (fl.)	50 c.c.s.
Saturated solution of alum, to	10 ,,	1000 ,,

SULPHOCYANIDE TONING SOLUTION.

(For Blue-Black and Blue Tones.)

A.	Chloride of gold	15 grs.	1 gm.
	Distilled water to make up ...	7½ ozs. (fl.)	212 c.c.s.
B.	Sulphocyanide of ammonium...	40 grs.	3 gms.
	Distilled water to make up ...	4 ozs. (fl.)	113 c.c.s.

Use 1 part of A and 4 parts of B, mixed at time of using. This order of mixing must not be reversed.

MAWSON'S "SIMPLEX" LANTERN PLATES.

Developer for Black Tones.

Amidol	100 grs.	20 gms.
Sulphite of sodium	1000 ,,	200 ,,
Bromide of potass	5 ,,	1 gm.
Distilled water to make ...	10 ozs.	1000 c.c.s.

Use 1 part to 4 parts of water.

Developer for Brown Tones.

A —Hydroquinone	20 grs.	4 gms.
Metabisulphite of potass ...	20 „	4 „
Bromide of potass	20 „	4 „
Distilled water to make ...	10 ozs.	1000 c.c.s.
B —Carbonate of potass	500 grs.	100 gms.
Sulphite of soda	100 „	20 „
Distilled water to make ...	10 ozs.	1000 c.c.s.

Use equal parts of A and B.

THE OZOTYPE CO.

The following are the working instructions for the Ozotype process (gelatine). The instructions for Gum Ozotype were published in the 1905 ALMANAC.

The sensitive paper is printed in daylight until all details are visible, except light clouds.

Washing.—The print should be washed in cold running water until the margin covered by the rebate of the printing frame is quite clean and white, but care should be taken not to wash too long.

The extent of washing is dependent upon the temperature of the water, the times given below being generally sufficient :—

6 to 10 minutes in summer.
15 to 20 minutes in spring and autumn.
20 to 30 minutes in winter.

Where running water is not available, wash in 4 changes for 5 minutes longer than the above-mentioned times. The printing and washing should be done as soon as possible after the receipt of the sensitised paper. After the print is washed and dried the pigmenting operation can be deferred for some months.

Pigmenting.—The following solution, called the "acid bath," should be prepared :—

CONCENTRATED ACID SOLUTION.

Warm water	10 ozs.	300 c.c.s.
Pure sulphate of copper ...	14 drachms	50 gms.
Glacial acetic acid	5 „	18 c.c.s.
Glycerine	4 „	15 „
Hydroquinone	4 „	15 gms.

This solution will keep several months in a workable condition.

WORKING BATH.

Concentrated acid solution as above	4 drachms	12 c.c.s.
Water	40 ozs.	1000 „

The diluted "acid bath" will keep good for about three days, and may be used for a number of prints in succession.

The best temperature for the "acid bath" is 60 degrees F. (16 C.) for smooth papers, and 75 degrees F. (24 C.) for rough papers.

Before placing the initial prints in the acid bath, it is advisable to note with a pencil the time on the back, and also the particular bath used.

Pour the acid solution into a porcelain dish somewhat larger than the print to be pigmented. Take the pigment plaster and place it in the acid bath, face downwards.

As soon as the plaster becomes limp (which will take place as a rule in 30 to 60 seconds after immersion), turn it face upwards in the bath. Now take the print (which may be either wet or dry), and immerse it gently face downwards under the surface of the solution, and remove any airbells by dipping and redipping the print several times. Then, without losing any time, bring the print into contact with the pigment plaster under the surface of the solution. Withdraw the two papers, clinging together, from the bath, and press them into contact with a flat squeegee upon some smooth, hard surface, such as a *papier mache* board or a sheet of zinc or glass. Then hang the plastered print up till ready for development.

N.B.—The operation of bringing the print into contact with the plaster in the acid bath should not take much longer than about 15 seconds, otherwise the acid may weaken the print.

Development.—Immerse the plastered print in water at about 110 to 115 degrees F., and wait for about half a minute, then try at the corner if the plaster backing is likely to strip off easily. If such is the case, separate the plaster backing from the print with a steady, unbroken pull. This should be done under the surface of the water. The development is now carried out by either leaving the picture in the water to gradually develop itself, or by supporting it on a zinc plate and pouring warm water upon it from a mug. A soft camel-hair brush may be used for brightening high-lights and putting in clouds, or otherwise modifying the picture.

After development there is nothing left that would affect the keeping quality of the picture; but should the print require to be hardened for wet mounting, etc., a bath of 5 per cent. solution of alum may be employed.

The Ozobrome Process.

Particulars will be found in "Epitome of Progress" under "Carbon."

THE PAGET PRIZE PLATE CO., LTD.

Developers for XXXXX "Swift" and XXX "Special Rapid" Plates.

Pyro-Ammonia.

P.	Pyrogallic acid	... 1 oz.	50 gms.
	Citric acid	... 60 grs.	7 ,,
	Sodium sulphite (pure)	... 2½ ozs.	125 ,,
	Distilled water to make	.. 20 ,,	1000 c.c.s.
A.	Liq. ammoniæ ·880 ...	... 1 oz.	50 c.c.s.
	Ammonium bromide ...	... 120 grs.	14 gms.
	Distilled water to make	... 20 ozs.	1000 c.c.s.

Studio Developer.—Dilute 1 part of P with 5 parts of water, and dilute 1 part of A with 5 parts of water. Mix the two dilute solutions in equal quantities for use. (Such developer contains about 2 grs. pyro, 2 minims ammonia, ½ gr. bromide, 5 grs. sulphite, ¼ gr citric acid, in each ounce.) If a thinner and softer negative be desired, use less of P.

Pyro-Soda.

1. Pyrogallic acid	¼ oz.	12·5 gms.
Sulphuric acid	5 drops	0·5 c.c.
Distilled water to make ...	20 ozs.	1000 c.c.s.
2. Carbonate of soda (cryst. pure)	2 ozs.	100 gms.
Sulphite of soda (pure) ...	2 ,,	100 ,,
Distilled water to make ...	20 ,,	1000 c.c.s.

For studio use, 1 part of each and 2 parts of water (making 4 parts altogether) will be found about right. Such developer contains about 3 grs. pyro and 22 grs. each of carbonate and sulphite to each oz.

Hydroquinone.

Stock Solutions.

No. 1. Hydroquinone	1 oz.	25 gms.
Sulphurous acid (B.P.) ...	½ ,,	12·5 ,,
Potass bromide...	¼ ,,	6·2 ,,
Distilled water to make ...	40 ozs.	1000 c.c.s.
No. 2. Caustic soda (in sticks) ...	1 oz.	25 gms.
Sodium sulphite	5 ozs.	125 ,,
Distilled water to make ...	40 ,,	1000 c.c.s.

These solutions may be used in equal quantities without dilution, or may be diluted with an equal or greater quantity of water, in order to get softer results; but hydroquinone alone is hardly a suitable developer for general subjects, as it has too much tendency to give hard, dense negatives with insufficient detail. It gives great density with very clear shadows, and is therefore extremely useful in cases where a negative of stencil-plate character is required, such as for copying woodcuts, line engravings, pen-and-ink sketches, printed matter, etc.

"Paget" Lantern Plate Developer.

Solution No. 1.

Hydroquinone	½ oz.	25 gms.
Sulphurous acid	¼ ,,	12·5 ,,
Potassium bromide	60 grs.	7 ,,
Water to...	20 ozs.	1000 c.c.s.

Solution No. 2.

Caustic soda	½ oz.	25 gms.
Sodium sulphite	2½ ozs.	125 ,,
Water to...	20 ,,	1000 c.c.s.

Solution No. 3 for Warm Tones.

Bromide of ammonium	...	1 oz.	50 gms.
Carbonate of ammonium	...	1 ,,	50 ,,
Water to...	...	20 ozs.	1000 c.c.s.

Carbonate of ammonium should be in clear lumps ; if from exposure to the air it has become coated with the white powdery bicarbonate, the latter should be scraped off.

The following table shows how the developer should be used for black and warm tones. The bromide of ammonium which is contained in No. 3 solution restrains the plate from developing too quickly, and the carbonate of ammonium, which also appears to act as a restrainer, assists in producing a much warmer deposit than can be secured by means of the use of the bromide alone. The longer the exposure which is given to the plate, the more of the No. 3 solution *must be used*, and the warmer the resulting slide will be. By following this simple method, a range of tones from black through warm black, brown, purple brown, and purple to red may be secured.

It should be noted that the proportion of the No. 3 solution used determines the *time of development* as well as the colour of the image. The table shows approximately the relative exposures, proportion of No. 3 solution, and time of development :—

Relative Time of Exposure.	Constitution of Developer.	Time of Development.	Colour of Deposit.
30 secs. ...	No. 1 ... ½ oz. No. 2 ... ½ ,, Water to make 2 ozs.	2½ to 3 minutes	Black
One minute...	No. 1 ... ½ oz. No. 2 ... ½ ,, No. 3 ...100 minims Water to make 2 ozs.	5 minutes ...	Brown
One and half minutes	No. 1 ... ½ oz. No. 2 ... ½ ,, No. 3 ...200 minims Water to make 2 ozs.	10 minutes...	Purple brown
Three minutes	No. 1 ... ½ oz. No. 2 ... ½ ,, No. 3 ...250 minims Water to make 2 ozs.	12 minutes ..	Purple
Five minutes	No. 1 ... ½ oz. No. 2 ... ½ ,, No. 3 ...300 minims Water to make 2 ozs.	15 minutes...	Red

"Gravura" Paper and Lantern Plates.

Developer for Black Tones.

Metol	1 oz.	6 gms.
Sodium sulphite	8 ozs.	48 ,,
Sodium carbonate (cryst.) ...	10 ,,	60 ,,
Potass bromide	16 grs.	·25 gm.
Water to make	160 ozs. (1 gallon)	1000 c.c s.

The addition of a few drops of cyanide solution, as advised under "Clearing Prints," is strongly recommended where *glossy* paper is used, or if the paper is at all old. In any case it does no harm to the print and helps to keep it clean.

The sulphite and carbonate of soda both vary much in quality; they must be good, and in clean, clear crystals. This developer, if kept in well-stoppered bottles, will remain in good condition for a long time, but cannot be kept *after use*, although the same developer may be used for several successive prints developed immediately after each other.

The above formula gives good gradation and an excellent black tone, but it *cannot* be used for colours.

Developer for Colours.

Stock Solution H.

Hydroquinone	1 oz.	55 grs.	6 gms.
Metol	¼ ,,	14 ,,	1·5 gm.
Sodium sulphite (re-cryst.)	8 ozs.	1 oz.	48 gms.
Sodium carbonate (cryst.)	10 ,,	1¼ ,,	60 ,,
Potass bromide	16 grs.	2 grs.	·25 gm.
Water to make	160 ozs. (1 gallon)	20 ozs.	1000 c.c.s.

Stock Solution A.C

Ammonium bromide	1 oz.	50 gms.
Ammonium carbonate... ...	1 ,,	50 ,,
Water to make	20 ozs.	1000 c.c.s.

Development for Colours.

Cool to Warm Sepias. Exposure—5 to 6 times Black.

Developer.

Stock solution H.	1 oz.	30 c.c.s.
Stock solution A.C. ...	50—60 minims	3—3·5 ,,
Water to make...	6 ozs.	170 ,,

Warm Brown to Red. Exposure—6 to 8 times Black.

Developer.

Stock solution H.	... ...	1 oz.	30 c.c.s.
Stock solution A.C.	... ...	¼ ,,	7 ,,
Water to make...	... ...	8 ozs.	230 ,,

Red Chalk. Exposure—8 to 10 times Black.

Developer.

Stock solution H.	... ...	1 oz.	30 c.c.s.
Stock solution A.C.	... ...	½ ,,	15 ,,
Water to make...	... ...	20 ozs.	570 ,,

Red development may take 5 minutes or more.

Clearing Solution.

To remove friction marks and improve colour and clearness of prints.

Stock Solution 1.

Hypo	1 oz.	50 gms.
Water	20 ozs.	1000 c.c.s.

Stock Solution 2.

Potass ferricyanide (Red prussiate of potash)	30 grs.	14 gms.
Water	5 ozs.	1000 c.c.s.

For use, add ½ drachm of No. 2 to each oz. of No. 1. and lay the print in the mixture, in a clean dish. The marks can then be easily removed by gentle rubbing with a pad of cotton wool. Wash and dry the print as usual.

Surface marks may be to a great extent prevented by adding to each oz. of developer 3 or 4 drops of a 10 per cent. solution of cyanide of potassium. This solution is extremely poisonous.

Paget Prize Gelatino-Chloride Printing-Out Paper.

ORDINARY OR MATT SURFACE.

Printing should be somewhat darker than the finished print is required.

It should be borne in mind, when toning, that the finished image will be bluer and slightly stronger when dry than in the wet state.

Toning.—The following bath is strongly recommended in preference to any other :—

Sulphocyanide of ammonia ...	24 grs.	2 gms.
Gold chloride	2 gr.	·15 ,,
Water	24 ozs.	1000 c.c.s.

Before immersion in this toning bath, the prints should be *very thoroughly washed* for at least 15 minutes in running water. This is necessary to ensure even toning.

If it is desired to tone more slowly, a small quantity of sulphite of sodium, say, from a ¼ to ½ a gr. for each grain of gold used, should be added to the toning bath. This makes the toning much *slower* and *more even*. In professional work, where a large number of prints are toned at once, the addition of sulphite is very useful, as the slower toning gives more time for examination.

If decidedly *warm* tones (really pure light browns and red browns) are desired, they cannot be satisfactorily obtained in the usual bath. In such cases the following formula is recommended :—

Gold chloride	1 gr.	.15 gm.
Ammonium sulphocyanide ...	8 grs.	11.5 gms.
Sodium sulphite, pure... ...	1 gr.	.15 gm.
Water to make	16 ozs.	1000 c.c.s.

Tone to the desired colour, judging by looking through. Toning is slow, taking from 5 to 10 or 12 minutes. When toned, wash the prints in water, fix and finish as usual.

Developing.

The Paget Partial Development process is given under Standard Formulæ for the Principal Photographic Processes.

Paget Prize Collodio-Chloride Printing-Out Paper.

Toning Bath.

A	Gold chloride	15 grs.	2 gms.
	Water	15 ozs.	1000 c.c.s.
B	Soda bicarbonate... ...	120 grs.	16 gms.
	Distilled water	15 ozs.	1000 c.c.s.

For use take 1 part A, 1 part B, and 28 parts water. The mixture does not keep; only enough for use should therefore be made up from the Stock Solutions as required.

Tone prints to a chocolate or reddish purple colour. Wash for five minutes. Then tone again in—

Potassium chloroplatinite ...	15 grs.	·5 gms.
Dilute Phosphoric Acid (Acid Phosph. dil. B.P.)	3 ozs.	50 c.c.s.
Water to make	60 ,,	1000 c.c.s.

If a bluer black is desired it may be obtained by using ½ oz. of lactic acid in the second bath instead of 3 ozs. phosphoric acid.

The prints should remain in this bath until quite black. They are then washed and fixed as usual.

The prints should be deeply printed, more than is required for sulphocyanide toning.

If a greenish black tone (Olive Green) is desired, it may be obtained by using the following acetate bath *instead* of the bicarbonate as the *first* bath—

Gold chloride	1 gr.	·06 gms.
Acetate of soda	30 grs.	2 ,,
Water	30 ozs.	1000 c.c.s.

This bath should stand for twelve hours before use, and will keep a long time. The print should be only slightly toned in this bath.

A very fine brown black may be obtained by the use of the chloroplatinite bath only. In this case the print should be placed, after first washing, in weak ammonia (say ½ oz. Liq. Am. ·880 to the pint of water) for a few seconds, then washed again for a minute and toned.

PAGET SELF-TONING PAPER.

Instructions.

Print a little deeper than finished print is required (about the same as for P.O.P.). To obtain a warm brown tone, wash print in running water, or several changes, for 5 minutes, then place in fixing bath—

Hypo	3 ozs.	150 gms.
Water	20 ,,	1000 c.c.s.

for 10 minutes; wash thoroughly and dry. If a colder tone be desired, *instead* of first washing, place print in a solution of—

Common salt	2 ozs.	100 gms.
Water	20 ,,	1000 c.c.s.

for 5 minutes, then rinse in water and fix as above.

The colour of the print cannot be judged while wet; its final tone is not arrived at until quite dry. Prints may be quickly dried in front of the fire as they do not soften like gelatine.

Prints on glossy paper may be burnished or otherwise treated in the same way as ordinary collodion paper.

BLACK TONES ON PAGET SELF-TONING PAPER.

A fine olive black tone can be obtained in the following way :—

Platinum Stock Solution.

Potassium chloroplatinite ...	15 grs.	1 gm.
Sodium chloride	150 ,,	10 gms.
Citric acid	150 ,,	10 ,,
Water to make	7½ ozs.	220 c.c.s.

For use, take 1 part of stock solution, and 10 parts water.

The prints must first be put into a bath of common salt 1 oz., water 10 ozs., for 5 minutes, washed, and then placed in the platinum bath, and kept constantly moving, until all trace of red has disappeared from the print when it is looked through. This will take from 5 to 10 minutes. Wash again for 5 minutes in running water, or several changes. Fix in the ordinary hypo fixing bath.

The platinum bath may be kept and used over and over again. When showing signs of exhaustion by toning too slowly, it may be strengthened by the addition of a small quantity of the stock solution.

Should a more olive tone be desired, omit the salt bath, but wash the prints very thoroughly before putting them in the platinum solution.

GLAZING COLLODION PRINTS.

If a highly glazed surface is desired take a piece of plate glass which has been made thoroughly clean, but need *not* be French chalked or prepared in any way. Lay the glass flat in a sink or on a level bench and wet its upper surface with clean water. Take the wet print out of the washing water, and lay it, face downwards, on the wet glass. Roll the back of the print several times backwards and forwards with a *roller* squeegee, rolling hard with firm pressure. Pressure is essential, otherwise you will not get a good gloss. Wipe or blot off any surplus water from the glass, and now dry the print on the glass before the fire, or in any way you like, so long as the

paper is not scorched, or the glass cracked. When thoroughly dry, wet the back of the print again, or you may put glass and all under water if preferred. In about 3 minutes you can lift one corner of the print, and with a steady pull peel it off the glass. It has now a splendidly glazed surface, which is not injured by any subsequent wetting, and therefore presents none of the usual difficulties in handling and mounting. As it is not injured by any moderate heat, the print may also be dried again in a few minutes.

PHOTOLINOL, LTD.

Developer for Photolinol Fabric.

Amidol	20 grs.	6·5 gms.
Sodium sulphite	180 ,,	58 ,,
Water	7 ozs.	1000 c.c.s.

Dissolve the amidol in half the water, the sulphite in the remaining water, and then put the *sulphite into the amidol*. The developer has to be thoroughly cooled down before using.

Sepia Toning Bath.

Bleaching Bath.

Potassium ferricyanide ...	1 oz.	100 gms.
Water	10 ozs.	1000 c.c.s.

Immerse until the image disappears. Then wash for 2 minutes and immerse in :—

Sodium sulphide	1 oz.	20 gms.
Water	50 ozs.	1000 c.c.s.

Then wash about 30 minutes.

"RAJAR" LIMITED.

Developer for "Cleron" Roll and Flat Films.

Pyro-Soda.

No. 1. Metabisulphite of potash ...	30 grs.	3·5 gms.	
Water	20 ozs.	1000	c.c.s.
Dissolve and add—			
Pyrogallic acid	¼ oz.	12·5 gms.	
No. 2. Carbonate of soda crystals ...	2 ozs.	100	g.m.s.
Sulphite of soda crystals ...	2 ,,	100	,,
Bromide of potassium	10 grs.	1	gm.
Water	20 ozs.	1000	c.c.s

For correct exposure, use one part of No. 1, and one part of No. 2.

For under exposure, use one part of No. 1, two parts of No. 2, and one part of water.

For over exposure, use two parts of No. 1, one part of No. 2, and 10 to 20 drops of a 10 per cent. solution of bromide of potassium per ounce of mixed developer.

"Rajar" Bromide Paper.

METOL-HYDROQUINONE.

Metol	8 grs.	·9 gm.
Hydroquinone	30 ,,	3·45 gms.
Sodium sulphite (cryst.) ...	¾ oz.	37·5 ,,
Sodium carbonate (cryst.) ...	¾ ,,	37·5 ,,
Potassium bromide	2 grs.	·2 gm.
Water	20 ozs.	1000 c.c.s.

"Rajar" P.O.P.

After removal from the printing frames, and when a sufficient number of prints have been made, they should be washed for from 10 to 15 minutes in running water, or in several changes of water, and they are then ready for toning. In engineering works, or where there is any iron in the water used, it is better to place the dry prints in a solution of salt (common salt 1 oz., water 40 ozs.) before washing. This bath completely prevents the iron from producing black specks in the prints.

TONING BATH.

Dissolve and add—

Water	20 ozs.	1000 c.c.s.
Sulphocyanide of ammonia ...	20 grs.	2·3 gms.
Gold chloride	2 ,,	·23 gm.

This bath produces dark brown to purple black tones, but if warm tones are desired it is advisable to dilute the bath with the following solution—

Sulphite of soda	2 grs.	·23 gm.
Water	20 ozs.	1000 c.c.s.

"RAJAR" SELF-TONING P.O.P.

When printed fix in the baths described below, then wash for an hour in water.

Depth of Printing.	Fixing bath. To the p nt water.	Time.	Tone.
Very dark (shadows blocked)...	6 ozs. hypo ...	6 minutes ...	Purple.
,, ,, (but shadows not so deep)	6 ,, ,, ...	6 ,, ...	Purple brown.
Fairly deep	3 ,, ,, ...	10 ,, ..	Sepia.
Usual depth	2 ,, ,, ...	10 ,, ...	Brown.
,, ,, ...	1 oz. ,, ...	15 ,, ...	Red brown.

"RAJAR" GASLIGHT PAPER.

Developer.

Water	20 ozs.	1000 c.c.s.
Metabisulphite of potash ...	20 grs.	2·0 gms.
Metol	16 ,,	1·6
Hydroquinone	60 ,,	6·0 ,,

Dissolve and add—

Sulphite of soda	480 ,,	48 ,,
Carbonate of soda	800 ,,	80 ,,
Potassium bromide	2 ,,	·2 gm.

ROTARY PHOTOGRAPHIC CO., LTD.

"Rotograph" Negative Paper.

A. Ortol	1 oz.	16·5	gms.
Potass metabisulphite... ...	½ ,,	8·2	,,
Water	60 ozs.	1000	c.c.s.
B. Soda carbonate (cryst.) ...	12 ,,	200	gms.
Soda sulphite (cryst.)	8 ,,	130	,,
Water	60 ,,	1000	c.c.s.

For use take A, 1 part; B, 1 part; water, 10 parts.

Fixing.—A 10 per cent. solution of hyposulphite can be used; but an acid bath made as follows is better :—

Sodium sulphite (cryst.) ...	1 oz.	50	gms.
Water	20 ozs.	1000	c.c.s.
Citric acid	100 grs.	11·5	gms.
Hypo	4 ozs.	200	,,

Mix the chemicals in the order given, adding the hypo after the sulphite and citric acid have completely dissolved.

Washing.—Wash for 1 hour in frequent changes. Be careful in washing and rinsing the paper that the stream of water does not run directly on the film. This is liable to lead to blisters of the film.

Hardening.—In order to harden the film of the negative paper, place for a few minutes in 10 per cent. alum solution, and wash afterwards for a quarter of an hour.

Drying.—The negatives are hung up or laid on blotting-paper.

The Paper is sufficiently transparent to print quickly without further treatment. If, however, great transparency is required, the following mixture should be rubbed into the back of the paper with cotton wool :—

Canada balsam	1 oz.
Turpentine	5 ozs.

Another method is to coat the back of the paper with a solution of castor oil, 1 oz., in absolute alcohol, 2 ozs.

"Rotary" Carbon Tissue and Stripping Films for Monochrome and Three-Colour Work.

Sensitising Bath.

Sensitise by immersion for 1 or 2 minutes in the following bath :—

Potass bichromate	1 oz.	30	gms.
Water	30 ozs.	900	c.c.s.
Ammonia (·880)...	1 drachm	3·5	,,

About 1 drachm of ammonia (·880) is added to every 30 ozs. of the bath; or a better way is to add the ammonia until the bath turns red litmus paper blue. The bath must be neutralised in this way, as, if left acid, the keeping properties of the sensitised tissue are greatly affected. The bath can be used several times, being stored in the dark. If it takes a brownish tint it must be discarded for a fresh one.

Stronger bichromate baths give a more sensitive tissue than weak ones. A tissue sensitised in a 4 per cent. bath is 4 times as sensitive as one treated in a bath of 1 per cent. The strength of the bath

likewise affects the character of the print, negatives of great contrasts requiring stronger baths and those tending to flatness, weaker baths. The temperature of the bath should not rise above 62 degrees F., otherwise the film of pigment and gelatine is softened and may even dissolve in certain circumstances.

Gelatine and chrome alum solution for use in assembling positives on the three-colour stripping films—

Ordinary gelatine	150 grs.	10 gms.
Warm water	20 ozs.	900 c.c.s.

After complete solution, add—

Chrome alum (10% solution) ...	¾ oz.	20 c.c.s.

Stirring well and filtering.

"ROTARY" COLLODIO-CHLORIDE PAPER.

TONING FORMULÆ FOR THE MATT PAPER.

Sodium acetate ...	96 grs.	2 gms
Chloride of gold ...	2½ „	5 c.c.s. of 1% solution.
Distilled water ...	20 ozs.	200 „

Make this bath up several hours before use.

The prints should be toned for a very short while in this bath, in fact only until they commence to change colour.

After the gold toning, wash thoroughly for a few minutes and transfer to the following platinum bath:—

Potassium chloroplatinite ...	12 grs.	1 gm.
Citric acid, pure	180 „	15 gms.
Distilled water	20 ozs.	800 c.c.s.

Make this bath up about an hour before use.

In this bath the prints should remain till the desired tone is attained. The tone passes from red to brown, brownish-black, blue-black to pure black. Too long toning in the gold bath, or too short immersion in the platinum bath gives blue-blacks, with frequently impure half-tones.

Very fine warm tones, somewhat similar to platinum prints, and which are very permanent, may be obtained merely by use of the above platinum bath, without the preliminary gold bath.

Red, sepia and violet tones can be obtained by short or long toning with the gold bath alone, and then fixing.

TONING FORMULA FOR THE GLOSSY PAPER.

After washing, the prints should be immersed in the following toning bath:—

Sodium acetate (fused)	528 grs.	5·5 gms.
Ammonium sulphocyanide ...	48 „	·5 gm.
Distilled water	20 ozs.	100 c.c.s.
Chloride of gold	½–¾ gr.	6 to 8 c.c.s. of 1% solution

Make this bath up several hours before use.

Tone to any point the finished prints are required to be, wash, fix, and wash.

"Rotograph" Bromide Papers and Rotograph "Satin." Metol Hydroquinone Developer.

Metol	50 grs.	5·8 gms.	
Hydroquinone	40 ,,	4·6 ,,	
Soda sulphite	500 ,,	58 ,,	
Potass bromide	25 ,,	2·9 ,,	
Sodium carbonate ...	500 ,,	58 ,,	
Water (distilled or boiled) to	20 ozs.	1000 c.c.s.	

This is a thoroughly reliable developer, yields brilliant prints, does not stain the fingers, and can be used repeatedly.

Amidol Developer.

Sodium sulphite	200 grs.	23 gms.
Water to...	6 ozs.	1000 c.c.s.
Potass bromide	1 gr.	·1 gm.
Amidol	20 grs	·7 ,,

Dilute 1 part of the above with 4 parts of water, and apply to the paper; as soon as the shadows have developed, pour off, and apply the strong solution till sufficient density is obtained; then pour off, wash well, and fix. This method gives rich blacks with brilliant whites.

Fixing Bath.

Soda sulphite	½ oz.	25 gms.	
Hypo	2 ozs.	100 ,,	
Water	20 ,,	1000 c.c.s.	
Sulphuric acid	20 minims	2 ,,	

Sulphide Toning.

The prints must first be bleached through the agency of potassium ferricyanide, for which purpose either of the following formulæ may be used :—

Potassium ferricyanide ...	10 grs.	2·3 gms.
Potassium or sodium chloride (common salt)	20 ,,	4·6 ,,
Water	10 ozs.	1000 c.c.s.

or—

Potassium ferricyanide ...	10 grs.	2·3 gms.
Potassium bromide or iodide...	10 ,,	2·3 ,,
Water	10 ozs.	1000 c.c.s.

After bleaching for a few seconds with either of these reagents it is only necessary to wash in running water from 3 to 5 minutes (according to the thickness of the paper), and then apply the following :—

Sodium sulphide	1 oz.	10 gms.
Water	100 ozs.	1000 c.c.s.

Two minutes' immersion will complete the toning action.

"Rotox" Gaslight Paper.

Rodinal Developer.

Rodinal	1 oz.	50 c.c.s.
Water	20 ozs.	1000 ,,
Potass bromide (10% solution)	25 minims	3 ,,

Metol-Hydroquinone.

Water	20 ozs.	1000 c.c.s.
Soda carbonate (cryst.) ...	2½ ,,	125 gms.
Soda sulphite (cryst.)	1 oz.	50 ,,
Metol	16 grs.	1·8 ,,
Hydroquinone	55 ,,	6·3 ,,
Potass bromide	3 ,,	·35 ,,

Pour the developer quickly and evenly over the whole print; or immerse the print film side down in the developer, turn it face up, and remove any air-bubbles with a tuft of cotton-wool.

Development takes place very quickly. If correctly exposed, the print attains full density in 5 to 10 seconds.

Avoid long development. Pure whites, proper colour in the shadows, and all the details in the picture can never be got if development has to be forced.

To stop development at once, place in the acetic acid bath as used for ferrous oxalate. Prints developed with alkaline developers, should remain here about half a minute, should be rinsed for 1 or 2 minutes in water, and transferred to the fixing bath. Formula for this is same as given above for "Negative Paper."

Make it a rule never to let prints lie one on the top of another in the fixing bath, but as soon as placed therein, keep them constantly on the move. This prevents spots and stains. After fixing, transfer to the alum or hardening bath, in which let the prints remain for 10 minutes.

ROUCH'S FORMULÆ.

A. Pyrogallic acid	1 oz.	100 gms.
Sulphite of soda	4 ozs.	400 ,,
Water to make	10 ,,	1000 c.c.s.

Dissolve the sulphite of soda in hot water, and, when cold, add the pyrogallic acid. Should any portion of the sulphite refuse to dissolve the crystals may be allowed to remain in the bottle.

B. Bromide of ammonium ...	1 oz.	100 gms.
Water to make	10 ozs.	1000 c.c.s.
C. Strongest liquor ammoniæ ...	3 ozs.	300 c.c.s.
Water to make	10 ,,	1000 ,,

In case sulphite of soda be not readily obtainable, the following may be substituted for solution A as above, and used in the same manner:—

Pyrogallic acid	1 oz.	100 gms.
Citric acid	50 grs.	11 ,,
Water to make	10 ozs.	1000 c.c.s.

Dissolve the citric acid first, and then add the pyro.

THOMAS'S FORMULÆ.

Lantern or Transparency Plates.

Developing Formulæ.

For Black and Warm Tones.

No. 1.	Hydroquinone	... 160 grs.	10 gms.
	Sodium sulphite ...	... 2 ozs.	60 ,,
	Citric acid	... 60 grs.	4 ,,
	Potassium bromide ...	... 40 ,,	2½ ,,
	Water to...	... 20 ozs.	600 c.c.s.
No. 2.	Sodium hydrate ...	... 160 grs.	10 gms.
	Water to...	... 20 ozs.	600 c.c.s.
No. 3.	Bromide ammonium ...	... 2 ozs.	60 gms.
	Water to...	... 20 ,,	600 c.c.s.
No. 4.	Carbonate ammonium...	... 2 ozs.	60 gms.
	Water to...	... 20 ,,	600 c.c.s.

For Black Tones.

No. 1	½ oz.	15 c.c.s.
No. 2	½ ,,	15 ,,
Water to ...	2 ozs.	60 ,,

For Brown Tones.

No. 1	½ oz.	15 c.c.s.
No. 2	½ ,,	15 ,,
No. 3	15 minims	1 c.c.
No. 4	15 ,,	1 ,,
Water to ...	2 ozs.	60 c.c.s.

For Purple Tones.

No. 1	½ oz.	15 c.c.s.
No. 2	½ ,,	15 ,,
No. 3	30 minims	2 ,,
No. 4	30 ,,	2 ,,
Water to ...	2 ozs.	60 ,,

For Red Tones.

No. 1	½ oz.	15 c.c.s.
No. 2	½ ,,	15 ,,
No. 3	90 minims	6 ,,
No. 4	90 ,,	6 ,,
Water to ...	2 ozs.	60 ,,

The relative times of exposure and development for these tones are :—

	Black.	Brown.	Purple.	Red.
Exposure ...	30 secs. at 24 in.	30 secs. at 6 in.	30 secs. at 5 in.	60 secs. at 5 in.
Development ...	4 minutes	10 minutes	18 minutes	30 minutes

Cold Tones.

No. 1.	Pyrogallic acid	... 1 oz.	30 gms.
	Metabisulphite of soda	... 1 ,,	30 ,,
	Water to	... 100 ozs.	3000 c.c.s.
No. 2.	Washing soda	... 6 ozs.	180 gms.
	Potassium bromide ...	... 20 grs.	1.5 gm.
	Water to	... 100 ozs.	3000 c.c.s.

Take equal parts of each solution, and development should be completed in 5 to 7 minutes. Slightly over-develop to allow for loss in fixing.

Purple Tones.

No. 1. Pyrogallic acid	1 oz.	30 gms.
Metabisulphite of soda ...	1 ,,	30 ,,
Water to	80 ozs.	2400 c.c.s.
No. 2. Ammonium bromide	8 ozs.	240 gms.
Liq. ammoniæ (·880)	4 ,,	120 c.c.s.
Water to	80 ,,	2400 ,,

Use equal parts of each solution.

This developer allows great latitude in exposure, and takes from 3 to 12 minutes to develop, according to the amount of exposure given.

When using this developer, the image will appear buried and lacking in density if examined by ruby light, but, when fixed, will be fully dense, and the deposit will appear opaque by reflected light, and purple by transmitted light, improving in colour when dry.

Fixing Bath.

Hyposulphite of soda	4 ozs.	110 gms.
10% solution of metabisulphite of soda	1 oz.	28 c.c.s.
Water to	20 ozs.	560 ,,

WELLINGTON AND WARD.

"Wellington" Speedy, Iso Speedy, and Landscape Plates.

Pyro and Ammonia Developer.

No. 1. Pyrogallic acid...	1 oz.	100 gms.
Sulphite of soda	2 ozs.	200 ,,
Citric acid	40 grs.	9·2 ,,
Water to...	10 ozs.	1000 c.c.s.
No. 2. Ammonia (·880)	1 oz.	100 c.c.s.
Water to...	10 ozs.	1000 ,,
No. 3. Ammonium bromide	1 oz.	100 gms.
Water to...	10 ozs.	1000 c.c.s.

Take 10 minims (2 c.c.s.) of No. 1, 10 minims of No. 2 and 5 minims (1 c.c.) of No. 3 to each ounce (100 c.c.s.) of water.

Pyro and Soda Developer.

No. 1. Pyrogallic acid	1 oz.	100 gms.
Sulphite of soda	2 ozs.	200 ,,
Citric acid	40 grs.	9·2 ,,
Water to	10 ozs.	1000 c.c.s.
No. 2. Carbonate of soda	8 ozs.	100 gms.
Sulphite of soda	8 ,,	100 ,,
Water to...	80 ,,	1000 c.c.s.

Normal Work.—Take 1 oz. of No. 2 and 1 dr. of No. 1, with water 1 oz.

Studio Work.—Take 1 oz. of No. 2 and ½ dr. of No. 1, with water 1 oz.

Fix in clean hypo 4 ozs. to the pint of water, after which wash as usual.

Wellington Celluloid Films.

The above pyro soda developer is used for the films, using—No. 1, 1 drachm; No. 2, 1 oz.; water, 1 oz.

For over-exposed negatives, add 10 to 20 drops of the following, in 4 ozs. of developer, according to amount of over-exposure :—

Bromide potass	1 oz.
Water...	10 ozs.

This restrainer is to be used only in case of over-exposure.

The "Wellington" Lantern Plate.

Hydroquinone—For Cold Tones.

Hydroquinone	80 grs.	9·2 gms.
Sulphite of soda	1 oz.	100 ,,
Potass hydrate	80 grs.	9·2 ,,
Ammonium bromide	10 ,,	1 gm.
Water	20 ozs.	1000 c.c.s.

Pyro and Ammonia—For Warm Black Tones.

(Recommended as the best.)

Three stock solutions are prepared as given above for "Speedy" plates. These are used as follows :—Take 30 minims of No. 1, 60 minims of No. 2, and 30 minims of No. 3, with water, 1 oz.

For warm black tones. Time of development, 2 minutes.

For warmer tones, increase the exposure 4 to 6 times, also increasing No. 3 up to 90 minims. Time of development, 5 to 6 minutes.

Fix in clean hypo, 4 ozs. to the pint of water, after which wash as usual.

The "Wellington" Etching Plate.

Pyro-Soda Developer.

No. 1. Pyrogallic acid	1 oz.	100	gms.
Sulphite of soda	2 ozs.	200	,,
Citric acid	40 grs.	9·2	,,
Water to...	10 ozs.	1000	c.c.s.
No. 2. Carbonate of soda	8 ozs.	100	gms.
Sulphite of soda	8 ,,	100	,,
Potass bromide	40 grs.	1	gm.
Water to...	80 ozs.	1000	c.c.s.

Take 1 oz. of No. 2 and 1 dr. of No. 1.

Fix in clean hypo, 4 ozs. to the pint of water, after which wash as usual.

Wellington-Platino Matt Bromide Paper.

Having made the exposure, immerse the paper face upward in water until thoroughly soaked, then drain off and immediately flow the developer evenly over the surface. Insufficient soaking is the cause of air bubbles, producing white spots. (For small prints it is preferable to flow the developer over the dry exposed paper.)

We advocate amidol as being the most reliable developer for general purposes, although any other may be used.

Amidol Developer.

Amidol	50 grs.
Sulphite soda	650 ,,
Potass bromide	10 ,,
Water...	20 ozs.

This developer should be used within three days of mixing.

It is often recommended to keep a stock solution of sodium sulphite by itself, and to take some of this when wanted and add the amidol to it. *Our experience is that this will not do*, as amidol when used with stale sulphite solution develops very slowly, and there is a great loss of brilliancy in the resulting prints—a result for which the poor manufacturer gets the blame. The developer given above should therefore be mixed up as directed, and used within three days of mixing.

Metol-Hydroquinone Developer.

Metol	50 grs.
Hydroquinone	15 ,,
Sulphite of soda	500 ,,
Potass bromide	10 ,,
Potass carbonate	100 ,,
Water...	20 ozs.

Dissolve the metol in the water first. This developer keeps well.

The same solution may be used for two or more prints in succession.

The fixing bath we recommend is an acid-hypo bath, prepared as follows :—

Stock Solution.

Sulphite of soda	1 lb.
Sulphuric or acetic acid	2 ozs.
Water to make	80 ,,

Acid Fixing Bath.

Hyposulphite of soda	4 ozs.
Stock acid sulphite solution as above... ...	1 oz.
Water	20 ozs.

In such a bath a bromide print is completely fixed in five minutes, and on no account should be taken out before that time has elapsed. To ensure proper fixing, the bath should be fresh—that is, it should not have been employed for a batch of prints before, and they simply must not be piled on the top of others in it, but kept quite separate.

Toning Bromide Prints.

Stock Solution.

Ferricyanide of potassium ...	400 grs.	90 gms.
Bromide of potassium... ...	600 ,,	140 ,,
Water	10 ozs.	1000 c.c.s.

Take 1 oz. to each 10 ozs. of water.

Take the dried print and immerse in above until the image becomes bleached—this usually takes place under 5 minutes. After this, a mere rinse in water, and it is placed in the following sulphurising bath :—

Stock Solution.

Sulphide of soda	1 oz.	100 gms.
Water	10 ozs.	1000 c.c.s.

Take $\frac{1}{2}$ oz. to 10 ozs. of water.

The image is converted into sulphide of silver very quickly, conversion being complete under a minute. Wash 15 minutes in running water.

Clearing and Reducing Bromide Prints.

In clearing up and brightening up a bromide print, removing surface markings or yellow stains or slight fog, the following bath will be found of great service. It should be applied after fixing and washing, the prints being left in until the desired clearing has taken place, and then removed and well washed :—

Thiocarbamide	20 grs.	4·6 gms.
Citric acid	10 ,,	2·3 ,,
Water	10 ozs.	1000 c.c.s.

This bath will not work unless all traces of hypo have been removed from the print.

Bright Prints from Very Weak Negatives.

The following method will be found to give bright vigorous prints from flat negatives when every other means has failed :—

Expose the bromide paper in the usual way, developing it as long as any increase in depth is seen to be gained, ignoring altogether the discoloration of the high-lights—over-develop it, in fact. After fixing and washing, pour over it the following reducing solution until it is seen to be considerably lighter ; when it is, at once plunge into clean hypo for a few minutes. If it is not yet light enough it may be again washed, treated with reducer, and fixed. When it is seen that any further reduction will render the blacks grey, it is washed and dried. Many a negative otherwise quite useless may in this way be saved :—

Potassium iodide	30 grs.
Water	10 ozs.
Iodine	3 grs.

With this bath the whites of the print will assume a dark blue tint, owing to the formation of iodide of starch due to the sizing of the paper; this immediately vanishes upon placing in the hypo solution.

"WELLINGTON" S.C.P. (SLOW CONTACT PAPER).

Metol-Hydroquinone Developer.

Metol	10 grs.
Hydroquinone	30 ,,
Sulphite of soda (cryst.)	350 ,,
Carbonate of soda (cryst.)	350 ,,
Bromide of potassium	3 ,,
Water	10 ozs.

Dissolve the above in the order named.

(This developer keeps indefinitely in well stoppered bottles.)

Using the above developer exactly as given, fine blue-black tones may be obtained. If softer results are required, expose the print a little longer and dilute the developer with a further 10 ozs. of water.

For very brilliant blue-black tones we recommend the following :—

Amidol Developer.

Sulphite of soda	500 grs.
Amidol	50 ,,
Bromide of potassium	2 ,,
Water	10 ozs.

This developer only keeps three days; after that time it should be discarded and fresh made up.

"WELLINGTON" ORDINARY P.O.P.

The prints must be thoroughly well washed, for at least 10 minutes, in many changes of water previous to toning.

Toning.—The following baths are equally good for obtaining most lovely warm or purple tones :—

Formate Toning Bath.

Sodium formate	15 grs.
Sodium bicarbonate	3 ,,
Gold chloride	2 ,,
Water (distilled)	40 ozs.

The bath is ready for use as soon as made up; it will not keep.

Print rather darkly, wash the prints well to thoroughly remove the free chloride. The quantity given above is sufficient to tone two full quire sheets of paper, and should be made up half an hour before using. It will not keep.

Caution.—Do not overtone. Well rinse and fix. The alum bath is only necessary when the prints have to be squeegeed on to glass; the formate and phosphate baths have no softening effect whatever on the gelatine, as is the case with sulphocyanide, and it is most important to keep the bath slightly alkaline with bicarbonate of soda, as it gets acid with use, owing to the formation of formic acid.

Phosphate Toning Bath.

Phosphate of soda	60 grs.
Gold chloride	2 ,,
Water...	40 ozs.

This bath should be allowed to stand 1 hour before using; it will not keep. The above quantity is sufficient for 24 half-plates.

Caution.—Care should be taken not to overtone, as prints become darker when dry. Judge the tone by the surface of the print and not by looking through it. For warm tones the prints must be decidedly red on leaving the toning bath; for purple tones there should be still a slight trace of red left.

The prints must now be well washed and then fixed in the following bath, where they should remain for not less than 10 minutes.

Fixing Bath.

Sodium hyposulphite	2 ozs.
Water	20 ,,

After fixing, wash thoroughly in running water for at least 1 hour. The prints may then be hung up to dry by means of clips, or to obtain a highly-glazed surface, squeegee them on to a ferrotype plate and there allow to remain until dry. On no account should they be placed between blotting-paper.

SPECIAL P.O.P. FOR SULPHOCYANIDE BATH ONLY.

Well wash the prints previous to immersion in the toning bath.

Ammonium sulphocyanide	20 grs.
Gold chloride	2 ,,
Water...	16 ozs.

The tone is to be entirely judged by the surface, and not by looking through the print. Always undertone, as the finished print becomes very much colder when dry. Fix in hyposulphite of soda, 1 oz. to 1 pint of water, allowing 15 minutes for complete fixation.

"WELLINGTON" SELF-TONING PAPER.

Print as for P.O.P.

Immerse prints direct, without washing, in the following:—

Fixing Bath.

Hyposulphite of soda	6 ozs.
Water...	20 ,,

The fixing bath should be rendered alkaline by the addition of 30 grains of bi-carbonate of soda, which prevents sulphur toning and ensures greater permanency of the print.

Fix until desired tone is reached, which should not be less than 8 minutes; then wash thoroughly, from half to one hour in running water if possible, or frequent changes.

Print dark enough, *i.e.*, several shades darker than is required for the finished print. The darker the print and the stronger the fixing bath, the colder will be the resulting tone, provided the print is allowed to remain in the bath a sufficient length of time. Do not allow prints to float on the surface of the fixing bath, or same may become stained. The fixing bath should not be of a lower temperature than 60° Fahr.

WRATTEN & WAINWRIGHT'S FORMULÆ.

DEVELOPING FORMULÆ.

Ten per cent. Pyro and Ammonia.

A.	Liquor ammoniæ	1 oz.	100 c.c.s.
	Bromide potassium*	100 grs.	21 gms.
	Water	10 ozs.	1000 c.c.s.
B.	Pyro	1 oz.	100 gms.
	Citric acid	60 grs.	12 ,,
	Or—		
	Sulphuric acid	½ drachm	6 c.c.s.
	Water	10 ozs.	1000 ,,

* For use with "I.D.S.," "Speed," or Colour-Sensitive Plates, the bromide in solution A should read—

Bromide potass...	110 grs.	22 gms.

For instantaneous and ordinary take from 60 (3 c.c.s.) to 90 minims (5 c.c.s.), and for "I.D.S.," "Speed," and Colour-Sensitive plates 90 minims (5 c.c.s.) of solution B, dilute with from 2 to 4 ozs. (60 to 120 c.c.s.) of water, and add 100 minims (6 c.c.s.) of solution A.

It is better to add solution A by instalments as development proceeds, unless the exposure is known to be either insufficient or quite accurate, in which cases it may be in one quantity.

PYRO SODA.

We recommend this developer for studio and hand-camera work.

No. 1.	Sulphite soda	6 ozs.	75 gms.
	Water	80 ,,	1000 c.c.s.
	Sulphuric acid or citric acid...	1 drachm	1·5 c.c.
	Pyro	1 oz.	13 gms.
No. 2.	Soda carbonate...	6 ozs.	75 ,,
	Water	80 ,,	1000 c.c.s.

For use, take equal parts of Nos. 1 and 2.

For denser negatives use the following more concentrated developer :—

3.	Sulphite soda	6 ozs.	100 gms.
	Water	60 ,,	1000 c.c.s.
	Sulphuric acid or citric acid...	1 drachm	2 c.c.s.
	Pyro	1 oz.	17 gms.
4.	Soda carbonate	6 ozs.	100 gms.
	Water	60 ,,	1000 c.c.s.

Take equal parts of Nos. 3 and 4.

METOL-HYDROQUINONE DEVELOPER.

For "Verichrome," "Allochrome," "Wratten Panchromatic," and "Bathed" Plates.

Metol	10 parts	¼ oz.
Hydroquinone	5 ,,	55 grs.
Sodium sulphite...	100 ,,	2½ ozs.
Sodium carbonate	100 ,,	2½ ,,
Water	6000 ,,	15 ,,

CHAS. ZIMMERMANN & CO.

"AGFA" ISOLAR PLATES.

Rodinal Developer.

In cases of normal exposure develop with—

Rodinal	1 part
Water	20 parts

In case of over-exposure with—

Rodinal	1 part
Water	10—20 parts

(adding an ample quantity of solution of potassium bromide, 1 : 0), and in case of under-exposure use—

Rodinal	1 part
Water	20—40 parts

Pyro-Soda Developer.

A. Water, boiled or distilled ...	60 ozs.	1000 c.c.s.
Sulphite of soda crystals ...	6 ,,	100 gms.
When dissolved add—		
Sulphurous acid	30 drops	15 drops
And then—		
Pyrogallic acid...	1 oz.	14 gms.
B. Carbonate of soda crystals ...	6 ozs.	100 gms.
Water, boiled or distilled ...	60 ,,	1000 c.c.s.

For general work use equal parts of A and B. To each ounce of mixed developer add 5 drops of a 10 per cent. solution of bromide of potassium.

If development has been performed with an alkaline developer, such as rodinal, eikonogen, metol, pyro, etc., the negative will be quite clear after fixing; but should ferrous oxalate or amidol have been used, there will in all probability be a red colouring of the gelatine, in which case, after fixing, give the plate a five minutes' wash and transfer to a bath of soda carb. 10 per cent. for seven minutes, wash again and replace in the acid fixing bath for ten minutes, and then wash as usual.

When being subsequently intensified or reduced the red colour may reappear, especially when mercury intensification is being employed. In such a case immerse the plate in a 10 per cent. soda carb. solution for seven minutes, and then wash until the colour has gone (about one hour).

"AGFA" "ISOLAR" LANTERN PLATES.

Rodinal Developer.

Rodinal	1 part.
Water	30—40 parts.

Fix in an acid fixing bath.

The fixed picture will usually be found to have a slight coloura-tion, which must be removed by the following operation:—Thoroughly rinse the plate after fixing, and immerse in soda carbonate 10 per cent. solution for five minutes. The colour will increase in this bath, but disappear entirely after a further wash and immersion in the acid fixing bath, after which wash as usual and then dry.

"AGFA" CHROMO PLATES.

Metol Hydroquinone.

We have found that the following formula is the best for these plates, giving brilliant vigorous negatives :—

Water	31¼ ozs.	1000 c.c.s.
Metol	15 grs.	5 gms.
Hydroquinone	23 ,,	7·5 ,,
Soda sulphite	3⅛ ozs.	100 ,,
Potass carb.	¼ oz.	20 ,,
Potass brom.	3 grs.	1 gm.

For a somewhat softer-working developer, giving fine harmonious gradation, we advocate the well-known rodinal, which for normal exposures should be diluted with 20 parts of water.

After vigorous washing fix in an acid fixing bath, such as the "Agfa" fixing salts.

"CROSSED SWORDS" PLATINO MATT P.O.P.

Toning Baths.

Carbon Red Tones.

Water	19 ozs.	1000 c.c.s.
Borax	41 grs.	5 gms.
Chloride of gold	1 gr.	·12 gm.

Must be made up two hours before use, but does not keep well.

Print to about required colour, not too deeply, wash in three changes of water, immerse in :—water 20 ozs., salt 2 drams, until the print has turned orange yellow. Wash once and then tone. When a very slightly lighter colour than desired is obtained, replace in the salt solution for five minutes, rinse and fix in :—hypo 2 ozs., water 40 ozs., freshly made.

Carbon Purple and Violet Tones.

Water	9 ozs.	250 c.c.s.
Hydrochloric acid	3 ,,	85 ,,
Gold chloride	3 grs.	·2 gm.

Print very deeply, wash thoroughly, and tone until desired colour is reached. Wash again and fix in :—hypo 2 ozs., water 40 ozs.

Less acid gives bluish violet. More acid gives red violet—purple.

Toning may be stopped at any stage.

Black Tones.

Wash prints in four changes of water before toning and place in:—

Potass chloroplatinite	15 grs.	1 gm.
Phosphoric acid (1·120) ...	2½ drms.	9 c.c.s.
Distilled water	35 ozs.	1000 ,,

When the pictures have assumed the desired black tone they are to be fixed in 5% hypo for ten minutes, and washed for half an hour in running water. These prints must not be washed before toning in the same bath as any other paper, and when removed from the final washing water they should be blotted off.

MISCELLANEOUS INFORMATION.

LIST OF THE PRINCIPAL WORKS ON PHOTOGRAPHY.

[The books mentioned below are obtainable by order of all photographic dealers.]

Elementary and General Text-books.

Burton's Modern Photography. By W. K. Burton. 1*s.*
Elementary Photography. By John A. Hodges. 1*s.*
Ilford Manual of Photography. By C. H. Bothamley, F.C.S. 1*s.*
Early Work in Photography. By W. Ethelbert Henry, C.E. 1*s.*
Hand-Camera Photography. By Walter Kilbey. 1*s.*
Photography in a Nutshell. By the Kernel. 1*s.*
The Figures, Facts, and Formulæ of Photography. By H. Snowden Ward. 1*s.*
Photographic Reference Book. By J. McIntosh. 1*s.* 6*d.*
The Science and Practice of Photography. By Chapman Jones. 5*s.*
Instruction in Photography. By Sir William Abney. 11th Edition. Revised and enlarged. 7*s.* 6*d.*
Dictionary of Photography. By E. J. Wall. 7*s.* 6*d.*
Photography: Its History, Processes, Apparatus, and materials. By A. Brothers. 21*s.*

Photographic Optics and Chemistry.

Optics for Photographers. By W. K. Burton. 1*s.*
Photographic Lenses: How to Choose and How to Use. By John A. Hodges. 2*s.*
Photographic Lenses. By Conrad Beck and Herbert Andrews. 1*s.*
The Lens. By Thos. Bolas and George E. Brown. 2*s.* 6*d.*
The Optics of Photography and Photographic Lenses. By J. Traill Taylor. 3*s.* 6*d.*
Photographic Optics, a Treatise on. By R. S. Cole. 6*s.*
Photographic Optics. By Otto Lummer. Translated by Silvanus Thompson. 6*s.*
First Book of the Lens. By C. Welborne Piper. 2*s.* 6*d.*
Telephotography. By T. R. Dallmeyer. 21*s.*
Elementary Telephotography. By Ernest Marriage. 3*s.* 6*d.*
Telephoto Work. By G. H. Deller. 1*s.*
Lens-work for Amateurs. By Henry Orford. 3*s.*
Tables of Conjugate Foci. For the Users of Photographic Lenses. Compiled and Explained by J. R. Gotz, F.R.P.S. 2nd Edition. 6*d.*
Chemistry for Photographers By Charles F. Townsend, F.C.S. 1*s.*
The Chemistry of Photography. By R. Meldola. 6*s.*

Art, Portraiture, Hand-camera Work, etc.

Naturalistic Photography. By Dr. P. H. Emerson. 3rd Edition. Revised, enlarged and re-written. 5*s.*

Picture-making by Photography. By H. P. Robinson. 2*s.* 6*d.*

Practical Essays on Art. By John Burnet. 1. Composition. 2. Light and Shade. 3. The Education of the Eye. 2*s.* 6*d.*

Art Photography. By H. P. Robinson. 1*s.*

Photography on Tour. 6*d.*

Practical Landscape Photography. By G. T. Harris. 1*s.*

The Photographic Studio. A guide to its construction, etc. By T. Bolas. 2*s.*

Artistic Lighting. By James Inglis. 2*s.* 6*d.*

The Lighting in Photographic Studios. By P. C. Duchochois. Revised, with additional matter by W. Ethelbert Henry, C.E. 1*s.*

Magnesium Light Photography. By F. J. Mortimer. 1*s*

Advanced Hand-Camera Work and Focal-Plane Photography. By W. Kilbey. 1*s.*

Stereoscope and Stereoscopic Photography. From the French of F. Drouin. 2*s.*

Photo-micrography. By E. J. Spitta. 12*s.*

Practical Photo-micrography. By Andrew Pringle. 3*s.* 6*d.*

Negative Processes.

Wet-collodion Photography. By Charles W. Gamble. 1*s.*

Practical Orthochromatic Photography. By Arthur Payne, F.C.S. 1*s.*

Action of Light in Photography. By Sir Wm. Abney, F.R.S. 3*s.* 6*d.*

Negative-making. By Sir William Abney, F.R.S. 1*s.*

The Watkins' Manual. By Alfred Watkins. 1*s.*

Photography by Rule. By J. Sterry. 1*s.*

Finishing the Negative. By George E. Brown. 2*s.* 6*d.*

Retouching. By Arthur Whiting. 1*s.*

Art of Retouching. By J. Hubert. 1*s.*

Art of Retouching Negatives, and Finishing and Colouring Photographs. By Robert Johnson. 2*s.*

Printing Processes.

Photographic and Photo-mechanical Printing Processes. By W. K. Burton. 4*s.*

Bromide Enlarging and Contact Printing. By S. Herbert Fry. 6*d.*

Toning Bromide Prints. By R. Blake-Smith. 1*s.*

Toning Bromides. By C. W. Somerville. 1*s.*

Photographic Enlargements: How to Make Them. By Geo. Wheeler. 1*s.*

Practical Photographic Enlarging. By John A. Hodges. 1*s.*

ABC Guide to Autotype Permanent Photography. By J. R. Sawyer. 1*s.*

Carbon Printing. By E. J. Wall. 1*s.*

Photo-aquatint, or Gum Bichromate Process. By Alfred Maskell and R. Demachy. 1*s.*

Platinotype: Its Preparation and Manipulation. By Sir William Abney and Lyonel Clark. 2*s.* 6*d.*

Ferric and Heliographic Processes. By George E. Brown, F.I.C. 2*s.*

Photographic Reproduction Processes. By P. C. Duchochois. A treatise on photographic impressions without silver salts. 2*s.* 6*d.*

Photo-ceramics. Photography applied to the decoration of plaques, pottery, and other ceramic and metallic surfaces. By W. Ethelbert Henry, C.E., and H. Snowden Ward. 1*s.*

Enamelling and Retouching. By Piquepe. 2*s.* 6*d.*

The Photographic Colourist. By J. W. Neville. 6*d.*

The Photographic Picture Postcard. By E. J. Wall and H. Snowden Ward. 1*s.*

Lanterns and Lantern Slides.

Modern Magic Lanterns. By R. Child Bayley. 1*s.*

The Lantern, and How to Use It. By Goodwin Norton. 1*s.*

Optical Projection. A treatise on the use of the lantern in exhibition and scientific demonstration. By Lewis Wright. 6*s.*

The Optical Lantern: for Instruction and Amusement. By Andrew Pringle, F.R.M.S. 2*s.* 6*d.*

Lantern Slide Making. By Rev. F. C. Lambert. 1*s.*

Living Pictures. By H. V. Hopwood. 2*s.* 6*d.*

Animated Photography. By Cecil M. Hepworth. 1*s.*

Photo-Mechanical Processes, etc.

Half-tone Process on the American Basis. By Wm. Cronenberg. 2*s.*

A Treatise on Photogravure in Intaglio. By the Talbot Klic process. By Herbert Denison, F.R.P.S. 4*s.* 6*d.*

Photo-mechanical Processes. By W. T. Wilkinson. 4*s.*

Photo-lithography. By George Fritz. Translated by E. J. Wall. 3*s.* 6*d.*

Photo-aquatint and Photogravure. A practical treatise with many illustrations, and photo-aquatint plate by the author. By Thomas Huson, R.I. 2*s.*

Professional Photography. By C. H. Hewitt. Vol. I., 1*s.* Vol. II., 1*s.*

Photography for the Press. By the Editors of *The Photogram.* 1*s.*

Practical Radiography. A handbook of the applications of the X-rays. With Illustrations. Third Edition. By A. W. Isenthal and H. Snowden Ward. 6*s.*

Colour Photography.

Photography in Colours. By Bolas, Tallent and Senior. 5*s.*

Three-colour Photography. By Baron von Hübl. Translated by H. O. Klein. 7*s.* 6*d.*

Natural-colour Photography. By Dr. E. König. Translated by E. J. Wall, 2*s.*

THE COPYRIGHT (WORKS OF ART) ACT (1862).

An Act for amending the Law relating to Copyright in Works of the Fine Arts, and for repressing the Commission of Fraud in the Production and Sale of such Works.

WHEREAS by law, as now established, the authors of paintings, drawings, and photographs, have no copyright in such their works, and it is expedient that the law should in that respect be amended: Be it therefore enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords spiritual and temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

Copyright in Works Hereafter Made or Sold to Vest in the Author for his Life, and for Seven Years after his Death.

1. The author, being a *British* subject or resident within the dominions of the Crown, of every original painting, drawing, and photograph which shall be or shall have been made either in the *British* dominions or elsewhere, and which shall not have been sold or disposed of before the commencement of this Act, and his assigns, shall have the sole and exclusive right of copying, engraving, reproducing and multiplying such painting or drawing, and the design thereof, or such photograph, and the negative thereof, by any means and of any size, for the term of the natural life of such author, and seven years after his death; provided that when any painting or drawing, or the negative of any photograph, shall for the first time after the passing of this Act be sold or disposed of, or shall be made or executed for or on behalf of any other person for a good or a valuable consideration, the person so selling or disposing of or making or executing the same shall not retain the copyright thereof, unless it be expressly reserved to him by agreement in writing, signed, at or before the time of such sale or disposition, by the vendee or assignee of such painting or drawing, or of such negative of a photograph, or by the person for or on whose behalf the same shall be so made or executed, but the copyright shall belong to the vendee or assignee of such painting or drawing, or of such negative of a photograph, or to the person for or on whose behalf the same shall have been made or executed; nor shall the vendee or assignee thereof be entitled to any such copyright, unless, at or before the time of such sale or disposition, an agreement in writing, signed by the person so selling or disposing of the same, or by his agent duly authorised, shall have been made to that effect.

Copyright not to prevent the Representation of the Same Subjects in Other Works.

2. Nothing herein contained shall prejudice the right of any person to copy or use any work in which there shall be no copyright, or to represent any scene or object, notwithstanding that there may be copyright in some representation of such scene or object.

Assignments, Licences, etc., to be in Writing.

3. All copyright under this Act shall be deemed personal or moveable estate, and shall be assignable at law, and every assignment thereof, and every license to use or copy by any means or process the design or work which shall be the subject of such copyright, shall be made by some note or memorandum in writing, to be signed by the proprietor of the copyright, or by his agent appointed for that purpose in writing.

Register of Proprietors of Copyrights in Paintings, Drawings, and Photographs to be kept at Stationers' Hall, as in 5 & 6 Vict., cap. 45.

4. There shall be kept at the Hall of the Stationers' Company, by the Officer appointed by the said Company for the purposes of the Act passed in sixth year of Her present Majesty, intituled *An Act to Amend the Law of Copyright*, a book or books, entitled "The Register of Proprietors of Copyright in Paintings, Drawings, and Photographs," wherein shall be entered a memorandum of every copyright to which any person shall be entitled under this Act, and also of every subsequent assignment of any such copyright; and such memorandum shall contain a statement of the date of such agreement or assignment, and of the names of the parties thereto, and of the name and place of abode of the person in whom such copyright shall be vested by virtue thereof, and of the name and place of abode of the author of the work in which there shall be such copyright, together with a short description of the nature and subject of such work and in addition thereto, if the person registering shall so desire, a sketch, outline, or photograph of the said work, and no proprietor of any such copyright shall be entitled to the benefit of this Act until such registration, and no action shall be sustainable nor any penalty recoverable in respect of anything done before registration.

Certain Enactments of 5 & 6 Vict., c. 45, to Apply to the Books to be Kept under this Act.

5. The several enactments in the said Act of the sixth year of Her present Majesty contained, with relation to keeping the register book thereby required, and the inspection thereof, the searches therein, and the delivery of certified and stamped copies thereof, the reception of such copies in evidence, the making of false entries in the said book, and the production in evidence of papers falsely purporting to be copies of entries in the said book, the application to the Courts and Judges by persons aggrieved by entries in the said book, and the expunging and varying such entries, shall apply to the book or books to be kept by virtue of this Act, and to the entries and assignments of copyright and proprietorship therein under this Act, in such and the same manner as if such enactments were here expressly enacted in relation thereto, save and except that the forms of entry prescribed by the said Act of the sixth year of Her present Majesty may be varied to meet the circumstances of the case, and that

the sum to be demanded by the officer of the said Company of Stationers for making any entry required by this Act shall be one shilling only.

Penalties on Infringement of Copyright.

6. If the author of any painting, drawing, or photograph in which there shall be subsisting copyright, after having sold or disposed of such copyright, or if any other person, not being the proprietor for the time being of copyright in any painting, drawing, or photograph, shall, without the consent of such proprietor, repeat, copy, colourably imitate, or otherwise multiply for sale, hire, exhibition, or distribution, or cause or procure to be repeated, copied, colourably imitated, or otherwise multiplied for sale, hire, exhibition, or distribution, any such work or the design thereof, or, knowing that any such repetition, copy, or other imitation has been unlawfully made, shall import into any part of the United Kingdom, or sell, publish, let to hire, exhibit, or distribute, or offer for sale, hire, exhibition, or distribution, or cause or procure to be imported, sold, published, let to hire, distributed, or offered for sale, hire, exhibition, or distribution, any repetition, copy, or imitation of the said work, or of the design thereof, made without such consent as aforesaid, such person for every such offence shall forfeit to the proprietor of the copyright for the time being a sum not exceeding ten pounds; and all such repetitions, copies, and imitations, made without such consent as aforesaid, and all negatives of photographs made for the purpose of obtaining such copies, shall be forfeited to the proprietor of the copyright.

Penalties on Fraudulent Productions and Sales.

7. No person shall do or cause to be done any or either of the follow Acts: that is to say,—

First, no person shall fraudulently sign or otherwise affix, or fraudulently cause to be signed or otherwise affixed to or upon any painting, drawing, or photograph, or the negative thereof, any name, initials, or monogram:

Secondly, no person shall fraudulently sell, publish, exhibit, or dispose of, or offer for sale, exhibition, or distribution, any painting, drawing, or photograph, or negative of a photograph, having thereon the name, initials, or monogram, of a person who did not execute or make such work:

Thirdly, no person shall fraudulently utter, dispose, or put off, or cause to be uttered or disposed of, any copy or colourable imitation of any painting, drawing, or photograph, or negative of a photograph, whether there shall be subsisting copyright therein or not, as having been made or executed by the author or maker of the original work from which such copy or imitation shall have been taken.

Fourthly, where the author or maker of any painting, drawing, or photograph, or negative of a photograph, made either before or after the passing of this Act, shall have sold or

otherwise parted with the possession of such work, if any alteration be afterwards made therein by any other person, by addition or otherwise, no person shall be at liberty, during the life of the author or maker of such work, without his consent, to make or knowingly to sell or publish, or offer for sale, such work or any copies of such work so altered as aforesaid, or of any part thereof, as or for the unaltered work of such author or maker.

Penalties.

Every offender under this section shall, upon conviction, forfeit to the person aggrieved a sum not exceeding ten pounds, or not exceeding double the full price, if any, at which all such copies, engravings, imitations, or altered works shall have been sold or offered for sale; and all such copies, engravings, or imitations, or altered works shall be forfeited to the person, or the assigns, or legal representatives of the person whose name, initials, or monogram shall be so fraudulently signed or affixed thereto, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as aforesaid: Provided always, that the penalties imposed by this section shall not be incurred unless the person whose name, initials, or monogram shall be so fraudulently signed or affixed, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as aforesaid, shall have been living at or within twenty years next before the time when the offence may have been committed.

Recovery of Pecuniary Penalties.

8. All pecuniary penalties which shall be incurred, and all such unlawful copies, imitations, and all other effects and things as shall have been forfeited by offenders, pursuant to this Act, and pursuant to any Act for the protection of copyright engravings, may be recovered by the person hereinbefore and in any such Act as aforesaid empowered to recover the same respectively, and hereinafter called the complainant or the complainer, as follows:

In *England* and *Ireland*, either by action against the party offending or by summary proceeding before any two Justices having jurisdiction where the party offending resides:

In *Scotland*, by action before the Court of Session in ordinary form, or by summary action before the Sheriff of the County where the offence may be committed or the offender resides, who, upon proof of the offence or offences, either by confession of the party offending or by the oath or affirmation of one or more credible witnesses, shall convict the offender, and find him liable to the penalty or penalties aforesaid, as also in expenses; and it shall be lawful for the Sheriff, in pronouncing such judgment for the penalty or penalties and costs, to insert in such judgment a warrant, in the event of such penalty or penalties and costs not being paid, to levy and recover the amount of the same by poinding: Provided always, that it shall be lawful to the Sheriff, in the event

of his dismissing the action and assoilising the defender, to find the complainer liable in expenses, and any judgment as to be pronounced by the Sheriff in such summary application shall be final and conclusive, and not subject to review by advocation, suspension, reduction, or otherwise.

Superior Courts of Record in which any Action is Pending may Make an Order for an Injunction, Inspection, or Account.

9. In any action in any of Her Majesty's Superior Courts of Record at *Westminster* and in *Dublin*, for the infringement of any such copyright as aforesaid, it shall be lawful for the Court in which such action is pending, if the Court be then sitting, or if the Court be not sitting then, for a judge of such Court, on the application of the plaintiff or defendant respectively, to make such order for an injunction, inspection, or account, and to give such direction respecting such action, injunction, inspection, or account, and the proceedings therein respectively, as to such Court or Judge may seem fit.

Importation of Pirated Works Prohibited.—Application in such Cases of Customs Act.

10. All repetitions, copies, or imitations of paintings, drawings, or photographs, wherein or in the design whereof there shall be subsisting copyright under this Act, and all repetitions, copies, and imitations of the design of any such painting or drawing, or of the negative of any such photograph, which, contrary to the provisions of this Act, shall have been made in any Foreign State, or in any part of the *British* dominions, are hereby absolutely prohibited to be imported into any part of the United Kingdom except by or with the consent of the proprietor of the copyright thereof, or his agent authorised in writing; and if the proprietor of any such copyright, or his agent, shall declare that any goods imported are repetitions, copies, or imitations of any such painting, drawing, or photograph, or of the negative of any such photograph, and so prohibited as aforesaid, then such goods may be detained by the Officers of Her Majesty's Customs.

Saving of Right to Bring Action for Damages

11. If the author of any painting, drawing, or photograph, in which there shall be subsisting copyright, after having sold or otherwise disposed of such copyright, or if any other person, not being the proprietor for the time being of such copyright, shall, without the consent of such proprietor, repeat, copy, colourably imitate, or otherwise multiply, or cause to procure to be repeated, copied, or colourably imitated, or otherwise multiplied for sale, hire, exhibition, or distribution, any such work or the design thereof, or the negative of any such photograph, or shall import or cause to be imported into any part of the United Kingdom, or sell, publish, let to hire, exhibit,

or distribute, or offer for sale, hire, exhibition, or distribution, or cause or procure to be sold, published, let to hire, exhibited or distributed, or offered for sale, hire, exhibition, or distribution, any repetition, copy, or imitation of such work, or the design thereof, or the negative of any such photograph, made without such consent as aforesaid, then every such proprietor, in addition to the remedies hereby given for the recovery of any such penalties, and forfeiture of any such things as aforesaid, may recover damages by and in a special action on the case, to be brought against the person so offending, and may in such action recover and enforce the delivery to him of all unlawful repetitions, copies, and imitations, and negatives of photographs, or may recover damages for the retention or conversion thereof: Provided that nothing herein contained, nor any proceeding, conviction, or judgment, for any act hereby forbidden, shall effect any remedy which any person aggrieved by such Act may be entitled to either at law or in equity.

Provisions of 7 & 8 Vict., c. 12, to be Considered as Included in this Act.

12. This Act shall be considered as including the provisions of the Act passed in the Session of Parliament held in the seventh and eighth years of Her present Majesty, intituled *An Act to Amend the Law relating to International Copyright*, in the same manner as if such provisions were part of this Act.

Reproduction Fees.

The Copyright Union has drawn attention to the following suggestions, drawn up for the guidance of its members, by Mr. Alfred Ellis :—

Members are advised not to give permission for their copyright photographs to be reproduced until they have full particulars of the size and style of the proposed reproduction, when they can formulate their charges accordingly. For example: a newspaper should pay a fee of not less than 10s. 6d. for half-tone black-and-white reproduction not exceeding 6 by 4 inches, when printed with letterpress in one issue of a newspaper; but, if it is to be printed as an inset the fee should be at least one guinea. If printed in colours, colotype, or photogravure, it should be a still higher fee. If a photograph is to be reproduced for advertising purposes, a higher fee should be charged than for newspaper work. In all cases, the permission must be in writing, and should state the fee to be paid, the process by which the photograph is to be reproduced, and whether in black-and-white or colours, the size limit, and the purpose for which the reproduction may be used.

The fee for reproduction on postcards should be not less than 10s. 6d. royalty per thousand for half-tone or collotype, and £1 1s. per thousand for bromide or ordinary photographic processes.

THE POISONS ACT.

The following is a list of poisons scheduled in the Poisons Act.

Schedule A.

Part 1.—Arsenic, and its preparations; aconite, and its preparations; alkaloids—all poisonous vegetable alkaloids and their salts; preparations of atropine; cantharides; corrosive sublimate; cyanides of potassium, and all metallic cyanides and the preparations of such articles; emetic tartar; ergot of rye, and its preparations; prussic acid, and its preparations; savin, and its oil; strychnine, and its preparations.

Part 2.—Essential oil of almonds (unless deprived of its prussic acid; belladonna and its preparations; tincture and all vesicating liquid preparations of cantharides; liquid preparations of carbolic acid, and homologues (if containing more than 3 per cent. of such substances); chloroform; chloral hydrate, and its preparations; preparations of corrosive sublimate; preparations of morphine; nux vomica, and its preparations; opium, and all preparations of opium or of poppies; oxalic acid; red precipitate (red oxide of mercury); white precipitate (ammoniated mercury). Cocaine and its salts, picrotoxin, preparations of cocaine, digitalis and its preparations, mercuric iodide, mercuric sulphocyanide, strophanthus and its preparations.

These poisons must not be sold by any except certified pharmacists under penalty of £5 for each offence. Poisons sold either retail or wholesale must be distinctly labelled with the name of the poison, the name and address of the seller, and the word "poison." In the case of the poisons in Part 1, it is forbidden to sell the same to any person unknown to the seller unless introduced by a person known to the seller, and on every sale the seller shall, before delivery, have entered in a book for the purpose the date of sale, name and address of the purchaser, name and quantity of the article sold, and the purpose for which it is required, to which entry the purchaser shall attach his signature.

THE PATENTS ACT.

Chapter 34.

An Act to amend the Law with reference to Applications for Patents and Compulsory Licences, and other matters connected therewith.

[18th December, 1902.]

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1.—(1) Where an application for a patent has been made and a complete specification has been deposited by the applicant, the examiner shall forthwith, in addition to the inquiries which he is directed to make by the Patents, Designs, and Trade Marks Act, 1883 (in this Act referred to as the principal Act), make a further investigation for the purpose of ascertaining whether the invention claimed has been wholly or in part claimed or described in any specification (other than a provisional specification not followed by a complete specification) published before the date of the application, and deposited pursuant to any application for a patent made in the United Kingdom within fifty years next before the date of the application.

(2) If on investigation it appears that the invention has been wholly or in part claimed or described in any such specification, the applicant shall be informed thereof, and the applicant may, within such time as may be prescribed, amend his specification, and the amended specification shall be investigated in like manner as the original specification.

(3) The examiner shall report to the comptroller the result of his investigations in such manner as the Board of Trade may direct.

(4) The provisions of subsection five of section nine of the principal Act, as amended by any subsequent enactment, shall apply to reports under this section.

(5) If the comptroller is satisfied that no objection exists to the specification on the ground that the invention claimed thereby has been wholly or in part claimed or described in a previous specification as before mentioned, he shall, in the absence of any other lawful ground of objection, accept the specification.

(6) If the comptroller is not so satisfied, he shall, after hearing the applicant, and unless the objection be removed by amending the specification to the satisfaction of the comptroller, determine whether a reference to any, and, if so, what, prior specifications ought to be made in the specification by way of notice to the public.

(7) An appeal shall lie from the decision of the comptroller under this section to the law officer.

(8) Section eight of the principal Act and section three of the Patents, Designs, and Trade Marks (Amendment) Act, 1885 (which regulate the time for depositing a complete specification), shall have effect as if references therein to the period of nine months were references to the period of six months.

(9) The investigations and reports required by this section shall not be held in any way to guarantee the validity of any patent, and no liability shall be incurred by the Board of Trade or any officer thereof by reason of, or in connection with, any such investigation or report, or any proceeding consequent thereon.

(10) The Board of Trade, with the sanction of the Treasury, may prescribe an additional fee not exceeding one pound in respect of the investigation mentioned in this section, which shall be payable on the sealing of the patent.

(11) This section shall come into operation at such date as the Board of Trade may by order direct, and shall apply only to applications made after that date, and the order shall be laid before both Houses of Parliament.

2. An invention covered by any patent granted on an application to which section one of this Act applies shall not be deemed to have been anticipated by reason only of its publication in a specification deposited

pursuant to an application made in the United Kingdom not less than fifty years before the date of the application to a patent therefor, or of its publication in a provisional specification of any date not followed by a complete specification.

3. Section twenty-two of the principal Act (relating to the grant of compulsory licences by the Board of Trade) is hereby repealed, and the following provisions shall be substituted therefor:—

(1) Any person interested may present a petition to the Board of Trade alleging that the reasonable requirements of the public with respect to a patented invention have not been satisfied, and praying for the grant of a compulsory licence, or, in the alternative, for the revocation of the patent;

(2) The Board of Trade shall consider the petition, and if the parties do not come to an arrangement between themselves, the Board of Trade, if satisfied that a primâ facie case has been made out, shall refer the petition to the Judicial Committee of the Privy Council, and, if the Board are not so satisfied, they may dismiss the petition.

(3) Where any such petition is referred by the Board of Trade to the Judicial Committee, and it is proved to the satisfaction of the Judicial Committee that the reasonable requirements of the public with reference to the patented invention have not been satisfied, the patentee may be ordered by an Order in Council to grant licences on such terms as the said Committee may think just, or, if the Judicial Committee are of opinion that the reasonable requirements of the public will not be satisfied by the grant of licences, the patent may be revoked by Order in Council;

Provided that no order of revocation shall be made before the expiration of three years from the date of the patent, or if the patentee gives satisfactory reasons for his default;

(4) On the hearing of any petition under this section the patentee and any person claiming an interest in the patent as exclusive licensee or otherwise, shall be made parties to the proceeding, and the law officer or such other counsel as he may appoint shall be entitled to appear and be heard;

(5) If it is proved to the satisfaction of the Judicial Committee that the patent is worked or that the patented article is manufactured exclusively or mainly outside the United Kingdom, then, unless the patentee can show that the reasonable requirements of the public have been satisfied, the petitioner shall be entitled either to an order for a compulsory licence, or, subject to the above proviso, to an order for the revocation of the patent;

(6) For the purposes of this section the reasonable requirements of the public shall not be deemed to have been satisfied if, by reason of the default of the patentee to work his patent or to manufacture the patented article in the United Kingdom to an adequate extent, or to grant licences on reasonable terms, (*a*) any existing industry or the establishment of any new industry is unfairly prejudiced, or (*b*) the demand for the patented article is not reasonably met;

(7) An Order in Council directing the grant of any licence under this section shall, without prejudice to any other method of enforcement, operate as if it were embodied in a deed granting a licence, and made between the parties to the proceeding;

(8) His Majesty in Council may make rules of procedure and practice for regulating proceedings before the Judicial Committee under this section, and, subject thereto, such proceedings shall be regulated according to the existing procedure and practice in patent matters. Any Order in

Council or any order made by the Judicial Committee under this Act may be enforced by the High Court as if it were an order of the High Court;

(9) The costs of and incidental to all proceedings under this section shall be in the discretion of the Judicial Committee, but in awarding costs on any application for the grant of a licence the Judicial Committee may have regard to any previous request for, of offer of, a licence made either before or after the application to the Committee;

(10) For the purposes of this section three members of the Judicial Committee shall constitute a quorum;

(11) This section shall apply to patents granted before as well as after the commencement of this Act.

4. In subsection four of section eighty-two of the principal Act (which relates to the performance of the duties of the comptroller by other officers under the direction of the Board of Trade) the words "in his absence" shall be repealed.

5. This Act may be cited as the Patents Act, 1902, and may be cited and shall be construed as one with the Patents, Designs, and Trade Marks Acts, 1883 to 1901.

INSURANCE COMPANIES AND EXHIBITIONS OF ANIMATED PHOTOGRAPHY

The following rules have been adopted by Insurance Companies as to the exhibition of animated pictures:—

1. The lantern must be constructed of metal or lined with metal and asbestos.

2. An alum or water bath must be used between the condenser and the film.

3. The apparatus must be fitted with a drop shutter available in case of emergency.

4. If the film does not wind upon a reel or spool immediately after passing through the machine, a metal receptacle with a slot in the metal lid must be provided for receiving it.

5 If electric arc lights are used, the installation must be in accordance with the usual rules, *i.e.*, the choking coils and switch to be securely fixed on incombustible basis, preferably on a brick wall, and d.p. safety fuses to be fitted.

6. If oxyhydrogen gas is used, storage must be in metal cylinders only.

7. The use of an ether saturator is not to be permitted under any circumstances.

Position.—Preferably on an open floor with a space of at least six feet all round railed off. If in a compartment, the compartment to be lined with fire-resisting materials. In any case no drapery or combustible hangings to be within two yards.

General.—Fire buckets to be kept filled, and a damp blanket to be provided and placed close at hand.

TABLES.

WEIGHTS AND MEASURES.

The formulæ in the editorial pages of this ALMANAC are given in almost all cases, in both British and metric measures, and in adopting this course we have had the desire to impress upon photographers the simplicity and facility of the latter system. As a rule, the British formulæ are expressed in grains or ounces per 20 ozs. of solution, and the metric formulæ in grammes per 1000 c.c.s. In regard to the total bulk of solution, our formulæ are mostly drawn up on the basis that the total bulk after the solution of the solids is that stated in the formula, 20 ozs. or 1000 c.c.s. as a rule. That this is intended is indicated by writing the proportion of water thus :—"water *to x* ounces."

The question of a 10 per cent. solution is a point in formulæ making and using which has caused endless discussion ; but it is really simple enough if it be borne in mind that the ounce avoirdupois contains 437½ grains, while the fluid ounce contains 480 minims. As 10 per cent. solutions, being strong, are usually measured out in minims, the ounce avoirdupois must be dissolved in enough water to make a solution containing 1 grain in 10 minims ; that is to say, 4,375 minims, or practically 9 ounces, is the proper bulk for the solution of 1 ounce avoirdupois. But if a solution is to be measured out in fluid ounces, then the 10 per cent. solution will be 1 oz. in 10 fluid ozs.

In regard to the conversion of the British into the metric units it was the intention of the present editor to adopt for the conversion of grains-per-ounce into grammes-per-litre the easy rule of Lord Crawford* as sufficiently accurate in the great majority of cases, and lending itself to the checking of the accuracy of the conversions by inspection. But the fact that a very large number of formulæ are already converted by a distinctly more accurate factor has been sufficient inducement to adopt a more laborious and exact method.

Throughout this work "grains per ounce" are converted into "grammes per litre" by multiplying by 2.3. Ounces per any given

* Divide the number of grains in any solution by half the number of ounces in which they are dissolved and write the result as grammes per litre. Thus :—40 grains in 16 ounces, 40 ÷ 8 = 5 grammes per litre.

number of fluid ounces are converted by taking the same ratio of grammes to 1000 c.c.s.

In reference to the names of chemicals, "sodium carbonate" and "sodium sulphite" are used for the crystallised forms of these substances. If the dry or anhydrous forms are meant, one or other of these terms is used in qualification.

British Weights and Measures.

1. APOTHECARIES WEIGHT.*

20 Grains = 1 Scruple.
3 Scruples = 1 Drachm = 60 Grains.
8 Drachms = 1 Ounce = 480 Grains.

2. AVOIRDUPOIS WEIGHT.*

437½ Grains = 1 Ounce.
16 Ounces = 1 Pound = 7000 Grains.

¼ ounce = 109 grains ; ½ ounce = 219 grains ; ¾ ounce = 328 grains.

3. FLUID MEASURE.

60 Minims = 1 Drachm.
8 Drachms = 1 Ounce = 480 Minims.
20 Ounces = 1 Pint = 160 Drachms = 9600 Minims.
2 Pints = 1 Quart = 40 Ounces = 320 Drachms
4 Quarts = 1 Gallon = 160 Ounces = 1280 Drachms

1 fluid ounce of water weighs 437½ grains, therefore every minim weighs 0.91 grains.

Metric Weights and Measures.

The unit of weight is the gramme, written "gm." ; the sub-divisions are the "deci-" (1/10th), "centi-" (1/100th), and "milligramme" (1/1000th) ; the multiples are the "deka-" (10 gm.) and "hectogramme" (100 gm.), but in practice it is usual to use the term .1 or .01 and 10 or 100 grammes, and the abbreviation "kilo." for 1000 gms.

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* It is now customary in formulæ to employ the avoirdupois ounce (437½ grains) ; but in cases were "drachms" are given, the apothecaries drachm of 60 grains is taken as the unit.

TABLE FOR CONVERTING GRAINS AND DROPS PER OUNCE INTO GRAMMES AND C.C.S. PER LITRE AND *VICE VERSA*.

1000 : 480	1000 : 437½		437½ : 1000	480 : 1000
3/25	7/64	1/4	4/7	25/48
4/25	7/8	1/3	16/21	25/36
6/25	7/32	1/2	1 1/7	1 1/24
8/25	7/24	2/3	1 11/21	1 7/18
9/25	21/64	3/4	1 5/7	1 9/16
12/25	7/16	1	2 2/7	2 1/12
24/25	7/8	2	4 4/7	4 1/6
1 1/25	1 5/16	3	6 6/7	6 1/4
1 23/25	1 3/4	4	9 1/7	8 1/3
2 2/25	2 3/16	5	11 3/7	10 5/12
2 22/25	2 5/8	6	13 5/7	12 1/2
3 9/25	3 1/16	7	16	14 7/12
3 21/25	3 1/2	8	18 2/7	16 2/3
4 8/25	3 15/16	9	20 4/7	18 3/4
4 4/5	4 3/8	10	22 6/7	20 5/6
5 7/25	4 13/16	11	25 1/7	22 11/12
5 19/25	5 1/4	12	27 3/7	25
6 6/25	5 11/16	13	29 5/7	27 1/12
6 18/25	6 1/8	14	32	29 1/6
7 1/5	6 9/16	15	34 2/7	31 1/4
7 17/25	7	16	36 4/7	33 1/3
8 4/25	7 7/16	17	38 6/7	35 5/12
8 16/25	7 7/8	18	41 1/7	37 1/2
9 3/25	8 5/16	19	43 3/7	39 7/12
9 4/5	8 3/4	20	45 5/7	41 2/3
14 1/25	13 1/8	30	68 4/7	62 1/2
19 1/5	17 1/2	40	91 3/7	83 1/3
24	21 7/8	50	114 2/7	104 1/6
28 4/5	26 1/4	60	137 1/7	125
33 3/5	30 5/8	70	160	145 5/6
38 2/5	35	80	182 6/7	166 2/3
43 1/5	39 3/8	90	205 5/7	187 1/2
48	43 3/4	100	228 4/7	208 1/3
52 1/5	47 1/2	109 3/8	250	227 11/96
57 3/5	52 1/2	120	274 2/7	250
70	63 7/16	145 5/6	333 1/3	307 1/4
76 4/5	70	160	365 5/7	333 1/3
105	95 1/4	218 3/4	500	455 5/8
115 4/5	105	240	548 4/7	500
120	109 3/8	250	571 3/7	520 5/6

When a number in the central column is that of the grains per avoirdupois ounce, the proportionate number of grammes per litre will be found next to it on the *right* hand. When a number in the central column is that of the grammes per litre, the proportionate number of grains per avoirdupois ounce will be found next to it on the *left* hand. Thus, 70 grains per ounce (central column) are equivalent to 160 grammes per litre (right hand). Again, 16 grammes per litre (central column) are equivalent to 7 grains per avoirdupois ounce (left hand). The outer columns may be used in conjunction with the central one in the same way, to convert drops per fluid ounce into c.c.s. per litre, and *vice versa*.

The following are the equivalents of Metric Weights and Measures in terms of Imperial Weights and Measures :—

Linear Measure.

1 Millimetre (mm.) (1/1000th M.)	=	0.03937 Inch
1 Centimetre (1/100th M.) ...	=	0.3937 ,,
1 Metre (M.)	=	39.370113 Inches 3.280843 Feet 1.0936143 Yards
Kilometre (1000 M.)	=	0.62137 Mile

Square Measure.

1 Square Centimetre	=	0.155 Square Inch
1 Square Metre (100 Square Decimetres)	=	10.7639 Square Feet 1.196 Square Yards

Cubic Measure.

1 Cubic Centimetre	=	0.061 Cubic Inch
1 Cubic Metre (1000 Cubic Decimetres)	=	35.3148 Cubic Feet 1.307954 Cubic Yards

		Weight. *Avoirdupois.*
1 Milligramme (1/1000th Gm.)	=	0.015 Grain
1 Gramme (1 Gm.)	=	15.432 ,,
1 Kilogramme (1000 Gm.) ...	=	2.2046223 lbs. or 15432.3564 Grains
		Apothecaries'.
1 Gramme (1 Gm.)	=	0.2572 Drachm 0.7716 Scruple 15.432 Grains

Fluid Measure.

1 Cubic Centimetre (C.C.) (1/1000th Litre) = 16.9 minims*

1 Litre (1 L.) = 35 ozs. 94 m. = 16894.1 minims

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* *Millilitre and C.C.*—Revisions of metric standards have shown that the litre is not exactly 1000 c.c.s., but 999.84 c.c.s. (according to Mendeeleef's calculations from the experimental data). The difference appears sufficiently serious in official circles to warrant the abandonment of the term "cubic centimetre," and the employment of "millilitre" for the true thousandth part; millilitre to be abbreviated to "mil." On grounds of terminology there is some reason for this, but until "millilitre" commences to oust c.c. from current writings we shall continue to use the latter term. As regards error, the difference is absolutely negligible. The voice of an academician may be raised to deplore the inaccuracy of the present metric system, but a system which is out of truth to the extent only of 4 drops in 35 ounces is good enough surely for every photographic purpose. In the metric measures given above we do not include the academic names centilitre and decilitre for the tenth and hundredth of a litre, as these are never used in practice, and only serve to confuse the student.

COINS AS WEIGHTS.

Silver coinage, it is useful to note, is minted exactly by weight in proportion to its value, viz., 436 4/11 grains for every 5s. Thus the threepenny bit is 21.8 grs.; a sixpence, 43.6; shilling, 87.2; florin, 175.4; half-crown, 218 grs.

Thus the sixpence and threepenny piece are almost exactly one-tenth and one-twentieth of the avoirdupois ounce.

Bronze coinage—

Three pennies, or five half-pennies, or ten farthings = 1 oz. (avoirdupois).

i.e., the penny = 145.8 grs., 1 half-penny, 87.5; and 1 farthing, 43.75 grs.

One sovereign weighs 123.27 grs.; the half-sovereign, 61.63 grs.

¼ oz. (avoir.) = one half-penny and one threepenny piece.
½ ,, ,, = two half-pennies and a farthing.
1 ,, ,, = three pennies (or five half-pennies).
2 ,, ,, = six pennies (or ten half-pennies).
4 ,, ,, = twelve pennies (or twenty half-pennies).

French Coins as Metric Weights.

Lord Crawford gives the following table:—

	Silver Coins.		*Bronze Coins.*
25 gms.... ...	5 francs	10 gms. ...	10 centimes
10 ,, ...	2 ,,	5 ,, ..	5 ,,
5 ,, ...	1 ,,	2 ,, ...	2 ,,
2½ ,, ...	½ ,, or 50 centimes	1 ,, ...	1 ,,

PARTS.

It is common to express formulæ in "parts," a system which is a stumbling block to many. The following table will enable anyone to convert a formula into the usual grains, ounces, etc. For instance, take the following formula:—Adurol, 10 parts; sodium sulphite, 100 parts; water, 1000 parts. Suppose that an operator wishes to convert this into grains and ounces, he would merely read 10 parts = 10

grs. ; 100 parts, 3 drs. 20 m. ; 1000 parts, 2 ozs. 40 m., which will give him the exact quantities to use.

Parts.	Grains.	Minims.	Gms.	Cubic Centimetres.
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
10	10	10	10	10
20	1 scruple.	20	20	20
50	50	50	50	50
60	1 drachm.	1 dr.	60	60
100	3 drs. 1 scr.	3 drs. 20 m.	100	100
250	½ oz. 32 grs.	½ oz. 10 m.	250	250
500	1 oz. 62 grs.	1 oz. 20 m.	500	500
1,000	2¼ ozs. 16 grs.	2 ozs. 40 m.	1,000	1,000
2,500	5½ ozs. 94 grs.	5 ozs. 1 dr. 40 m.	2,500	2,500
5,000	11¼ ozs. 79 grs.	10 ozs. 3 drs. 20 m.	5,000	5,000
10,000	1 lb. 6¾ ozs. 49 grs.	20 ozs. 6 drs. 40 m.	10,000	10,000

The ounce of solids in the above table is avoirdupois of 437.5 grains.

GRAMMES INTO GRAINS AND OUNCES (Av.)

Gm.	Grains.	Gm.	Oz.	Gr.	Gm.	Oz.	Gr.
0.1	1.5	16		246.9	130	4	256
0.2	3.1	17		262.3	140	4	410
0.3	4.6	18		277.8	150	5	127
0.4	6.2	19		293.2	160	5	280
0.5	7.7	20		308.6	170	6	0
0.6	9.1	25		385.8	175	6	76
0.7	10.8	30	1	25	180	6	153
0.8	12.4	35	1	103	190	6	307
0.9	13.9	40	1	180	200	7	24
1	15.43	45	1	257	250	8	360
2	30.9	50	1	334	300	10	250
3	46.3	55	1	411	350	12	150
4	61.7	60	2	51	400	14	50
5	77.2	65	2	128	450	15	380
6	92.6	70	2	205	500	17	280
7	108.0	75	2	282	550	19	175
8	123.5	80	2	360	600	21	70
9	138.6	85	3	0	650	22	400
10	154.3	90	3	76	700	24	300
11	169.8	95	3	153	750	26	200
12	185.2	100	3	230	800	28	95
13	200.6	110	3	384	850	29	430
14	216.1	120	4	102	900	31	325
15	231.5	125	4	179	1000	35	120

C.C.S. INTO MINIMS AND OUNCES.

C.c.	Oz.	Min.	C.c.	Oz.	Min.	C.c.	Oz.	Min.
0.1		1 7	55	1	449	350	12	153
0.2		3.4	60	2	54	375	13	95
0.3		5.1	65	2	138	400	14	37
0.4		6.8	70	2	223	425	14	460
0.5		8.5	75	2	307	450	15	402
0.6		10.1	80	2	392	475	16	345
0.7		11.8	85	2	476	500	17	287
0.8		13.5	90	3	81	525	18	230
0.9		15.2	95	3	165	550	19	172
1		16.9	100	3	250	575	20	114
2		33.8	110	3	418	600	21	56
3		50.7	120	4	107	625	22	0
4		67.6	125	4	192	650	22	421
5		84.5	130	4	276	675	23	364
6		101.4	140	4	445	700	24	306
7		118.3	150	5	134	725	25	248
8		135.2	160	5	303	750	26	190
9		152	170	5	472	775	27	133
10		169	175	6	76	800	28	75
15		253	180	6	161	825	29	18
20		338	190	6	330	850	29	440
25		422	200	7	20	875	30	382
30	1	27	225	7	441	900	31	325
35	1	111	250	8	384	925	32	267
40	1	196	275	9	326	950	33	210
45	1	280	300	10	268	975	34	152
50	1	365	325	11	210	1000	35	94

GRAINS INTO GRAMMES.

Gr.	Gm.	Gr.	Gm.	Gr.	Gm.
1	.065	16	1.037	35	2.268
2	.13	17	1.102	40	2.592
3	.194	18	1.166	45	2.916
4	.259	19	1.232	50	3.240
5	.324	20	1.296	55	3.564
6	.389	21	1.361	60	3.888
7	.454	22	1.426	65	4.212
8	.518	23	1.490	70	4.536
9	.583	24	1.555	75	4.860
10	.648	25	1.620	80	5.184
11	.713	26	1.685	85	5.508
12	.775	27	1.750	90	5.832
13	.842	28	1.814	95	6.156
14	.907	29	1.880	100	6.480
15	.972	30	1.944		

OUNCES (AVOIRDUPOIS) TO GRAMMES.

Oz.	Gm.	Oz.	Gm.	Oz.	Gm.
¼	7.09	4	113.40	13	368.54
½	14.17	5	141.75	14	396.89
¾	21.26	6	170.10	15	425.24
1	28.35	7	198.45	16	453.59
1½	42.5	8	226.80	17	481.94
2	56.70	9	255.15	18	510.29
2½	70.87	11	311.8	19	538.64
3	85.05	12	340.19	20	566.99

FLUID OUNCES AND DRACHMS TO C.C.S.

Drm.	C.c.	Oz.	C.c.	Oz.	C.c.
½	1.78	1½	42.6	11	312.5
1	3.55	2	56.8	12	341.
2	7.10	3	85.2	13	369.3
3	10.65	4	113.6	14	398.
4	14.20	5	142.0	15	426.
5	17.75	6	170.5	16	454.5
6	21.30	7	198.9	17	483.
7	24.86	8	227.3	18	511.5
8	28.41	9	255.7	19	540.
		10	284.	20	568.

MILLIMETRES INTO INCHES.

Millimetres.	Inches.	Millimetres.	Inches.
0.1	0.0039	13	0.51
0.5	0.015	14	0.55
1	0.04	15	0 59
2	0.08	16	0 63
3	0.12	17	0 67
4	0.16	18	0.71
5	0.20	19	0.75
6	0.24	20	0.79
7	0.28	21	0.83
8	0.31	22	0.87
9	0.53	23	0.90
10	0 39	24	0.94
11	0.43	25	0.98
12	0.47	25.4	1.0

INCHES INTO MILLIMETRES.

Inches.		Millimetres.	Inches.		Millimetres.
In decimal fractions.	In vulgar fractions.		In decimal fractions.	In vulgar fractions.	
1.	—	25.4	0.37	$\frac{3}{8}$	9.5
0.94	$\frac{15}{16}$	23.8	0.34	$\frac{11}{32}$	8.7
0.90	$\frac{9}{10}$	23.	0.31	$\frac{5}{16}$	7.9
0.87	$\frac{7}{8}$	22.2	0.28	$\frac{9}{32}$	7.1
0.81	$\frac{13}{16}$	20.6	0.25	$\frac{1}{4}$	6.4
0.75	$\frac{3}{4}$	19.1	0.22	$\frac{7}{32}$	5.6
0.69	$\frac{11}{16}$	17.5	0.19	$\frac{3}{16}$	4.8
0.62	$\frac{5}{8}$	15.9	0.13	$\frac{1}{8}$	3.2
0.56	$\frac{9}{16}$	14.3	0.09	$\frac{3}{32}$	2.4
0.50	$\frac{1}{2}$	12.7	0.06	$\frac{1}{16}$	1.6
0.44	$\frac{7}{16}$	11.1	0.03	$\frac{1}{32}$	0.8

METRICAL SIZES CONVERTED INTO ENGLISH MEASURES.

Centimetres.	Inches.	Centimetres.	Inches.
4×4	1.57× 1.57	21×15	8.26× 5.91
6×4½	2.36× 1.77	24×18	9.44× 7.08
9×6½	3.54× 2.56	27×21	10.63× 8.26
12×9	4.72× 3.54	30×24	11.81× 9.44
18×9	7.08× 3.54	33×27	13.0 ×10.63
15×11	5.91× 4.33	36×24	14.17× 9.44
16×12	6.30× 4.72	40×30	15.75×11 81
18×13	7.08× 5.12	48×36	18.90×14.17
20×12	7.87× 4.72	50×40	19 69×15.75
		60×50	23.62×19.69

ENGLISH AND METRICAL SIZES OF PLATES.

English sizes converted into Metric Measure.

Inches.	Centimetres.	Inches.	Centimetres.
$2\frac{5}{16}\times1\frac{3}{4}$	6. × 4.5	‖$8\frac{1}{2}\times6\frac{1}{2}$	21.5 ×16.5
*$3\frac{1}{4}\times3\frac{1}{4}$	8.25× 8.25	10 ×8	25.4 ×20.3
†$4\frac{1}{4}\times3\frac{1}{4}$	10.8 × 8.25	12 ×10	30.4 ×25.4
5 ×4	12.6 ×10.1	15 ×12	38.1 ×30.4
‡$6\frac{3}{4}\times3\frac{1}{4}$	17.1 × 8.25	18 ×16	45.6 ×40.5
$6\frac{1}{2}\times4\frac{1}{4}$	16.5 ×10.8	20 ×16	50.8 ×40.5
¶$6\frac{1}{2}\times4\frac{3}{4}$	16.5 ×12.	22 ×18	55.9 ×45.6
7 ×5	17.8 ×12.7	24 ×20	61.0 ×50.8
$7\frac{1}{2}\times5$	19.0 ×12.7	30 ×24	76.2 ×61.0
8 ×5	20.3 ×12.7		

* Lantern plate. † Quarter plate. ‡ Stereoscopic. ¶ Half plate. ‖ Whole plate.

DIAPHRAGMS STANDARDS.

The present recommendations of the Royal Photographic Society are as follows:— LENS DIAPHRAGMS.

1. That intensity ratio be defined as dependent upon the *effective aperture*, and not upon the diameter of the diaphragm, in relation to the focal length of the lens

2. That effective aperture be determined in the following manner: The lens shall be focussed for parallel rays; an opaque screen shall be placed in the principal focal plane, the plate being provided in its centre (in the axis of the lens) with a pin-hole; an illuminant shall be placed immediately behind the pin-hole, and the diameter of the beam of light emerging from the front surface of the lens shall be the measure of the effective aperture.

NOTE.—It will be found, except when the diaphragm is situated in front of the lens, that the diameter of the diaphragm itself is seldom identical with the effective aperture.

3. That every diaphragm be marked with its true intensity ratio, as above defined, in the following order of sequence: *f*/1, *f*/1.4.., *f*/2, *f*/2.8.., *f*/4, *f*/5.6.., *f*/8, *f*/11.3.., *f*/16, *f*/22.6.., *f*/32, *f*/45.2.., *f*/64, etc., each diaphragm requiring double the exposure required by the preceding diaphragm.

Should the greatest effective aperture of a lens not conform exactly to one of the intensities set forth above, this aperture should be marked in accordance with the definition of effective aperture, but all succeeding smaller apertures should be marked in uniformity with the intensities recommended in the above sequence.

The recommendations of the Society as to standard lens, mounts, and fittings will be found in the "British Journal Almanac" for 1905 and previous years.

A TABLE OF ATOMIC WEIGHTS OF THE CHEMICAL ELEMENTS.

NAME.	Symbol.	Atomic Weight in Round Numbers.	Accurate Atomic Weight.
Aluminium	Al	27	27·1
Antimony	Sb	120	120·2
Argon	A	40	39·9
Arsenic	As	75	75·0
Barium	Ba	137	137·43
Beryllium	Be=Gl	91	9·1
Bismuth	Bi	208	208·0
Boron	B	11	11·00
Bromine	Br	80	79.96
Cadmium	Cd	112	112·4
Cæsium	Cs	133	132·9
Calcium	Ca	40	40·1
Carbon	C	12	12·0
Cerium	Ce	140	140·25
Chlorine	Cl	35·5	35·451
Chromium	Cr	52	52·11
Cobalt	Co	59	59·00
Copper	Cu	63·5	63.60
Erbium	Er	166	166 0
Fluorine	F	19	19·0
Gadolinium	Gd	156	156 01
Gallium	Ga	70	70·0
Germanium	Ge	72·5	72·5
Gold	Au	197	197·2
Helium	He	4	4·0
Hydrogen	H	1	1·008
Indium	In	115	115·0
Iodine	I	127	126·97
Iridium	Ir	193	193·0
Iron	Fe	56	55·9
Lanthanum	La	139	138·9
Lead	Pb	207	206·92
Lithium	Li	7	7·03
Magnesium	Mg	24	24·36
Manganese	Mn	55	55·0
Mercury	Hg	200	200·0

A TABLE OF ATOMIC WEIGHTS—CONTINUED.

NAME.	Symbol.	Atomic Weight in Round Numbers.	Accurate Atomic Weight.
Molybdenum	Mo	96	96·0
Neodymium	Nd	144	143·6
Nickel	Ni	59	58·70
Niobium	Nb=Cb	94	94·0
Nitrogen	N	14	14·04
Osmium	Os	191	191·0
Oxygen (Standard)	O	16	16·0
Palladium	Pd	106	106·5
Phosphorus	P	31	31·0
Platinum	Pt	193·4	194·8
Potassium	K	39	39·15
Praseodymium	Pr	141	140·5
Rhodium	Rh	103	103·0
Rubidium	Rb	85	85·5
Ruthenium	Ru	102	101·7
Samarium	Sm	150	150·3
Scandium	Sc	44	44·1
Selenium	Se	79	79·2
Silicon	Si	28	28·4
Silver	Ag	108	107·93
Sodium	Na	23	23·05
Strontium	Sr	87·5	87·6
Sulphur	S	32	32·06
Tantalum	Ta	183	183·0
Tellurium	Te	128	127·6
Terbium	Tb	160	160·0
Thallium	Tl	204	204·1
Thorium	Th	233	232·5
Thulium	Tu	171	171·0
Tin	Sn	118	119·0
Titanium	Ti	48	48·1
Tungsten	W	184	184·0
Uranium	U	240	238·5
Vanadium	V	51	51·4
Ytterbium	Yb	173	173·0
Yttrium	Yt	89	89·0
Zinc	Zn	65	65·4
Zirconium	Zr	91	90·6

TABLE OF SYMBOLS AND EQUIVALENT WEIGHTS OF THE MORE IMPORTANT COMPOUNDS USED IN PHOTOGRAPHY.

The atomic weights of the elements employed in working out the equivalent weights given below are the round numbers contained in the first column of the Table of Atomic Weights on page 1094.

NAME.	SYMBOL.	EQUIV WEIGHT.
Acetone	$C_3 H_6 O$	58
„ Sulphite	$C_3 H_6 OH SO_3 Na$	162
Acid, Acetic	$C_2 H_4 O_2$	60
„ Benzoic	$C_6 H_5 COOH$	122
„ Boric	$H_3 BO_3$	62
„ Carbolic	$C_6 H_5 OH$	94
„ Chromic (Anhydride)	$Cr O_3$	100
„ Citric	$C_6 H_8 O_7 H_2O$	210
„ Formic	$H_2 CO_2$	46
„ Gallic	$C_6 H_2 (OH)_3 COOH. H_2 O$	188
„ Hydrobromic	$H Br$	81
„ Hydrochloric	$H Cl$	36·5
„ Hydrofluoric	$H F$	34
„ Lactic	$CH_3 CH (OH) COOH$	90
„ Nitric	HNO_3	63
„ Oxalic	$H_2 C_2 O_4$	126
„ Phosphoric	$H_3 PO_4$	98
„ Picric	$C_6 H_2 (NO_2)_3 OH$	139
„ Pyrogallic	$C_6 H_3 (OH)_3$	126
„ Salicylic	$C_6 H_4 (OH) COOH$	138
„ Sulphuric	$H_2 SO_4$	98
„ Sulphurous	$H_2 SO_3$	82
„ Tannic	$C_{14} H_{10} O_9$	322
„ Tartaric	$C_2 H_2 (OH)_2 (COOH)_2$	150
Adurol*	$C_6 H_3 (OH)_2 Cl$ (or Br)	—
Alcohol (Methyl)	$CH_3 OH$	32
„ (Ethyl)	$C_2 H_5 OH$	46
Alum, Ammonia	$Al_2 (NH_4)_2 (SO_4)_4 24H_2O$	906
„ Chrome	$Cr_2 K_2 (SO_4)_4 24H_2O$	998
„ Iron Ammonia	$Fe_2 (NH_4)_2 (SO_4)_4 24H_2O$	964
„ Potash	$Al_2 K_2 (SO_4)_4 24H_2O$	948
Aluminium, Chloride	$Al_2 Cl_6 12H_2O$	267
„ Sulphate	$Al_2 (SO_4)_3 16H_2O$	634
„ Sulphocyanide	$Al_2 (CNS)_6$	402
Amidol	$C_6 H_3 OH NH_2 HCl$	144·5
Ammonia	NH_3	17
Ammonium, Bichromate	$(NH_4)_2 Cr_2 O_7$	252
„ Bromide	$NH_4 Br$	98
„ Carbonate	$NH_4 HCO_3 + NH_2 COOH NH_4$	—
„ Chloride	$NH_4 Cl$	53·5
„ Citrate	$(NH_4)_2 C_6 H_6 O_7$	226

* Adurol is mono-chlor (or mono-brom) hydroquinone.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Ammonium, Iodide	$NH_4 I$	145
,, Molybdate	$(NH_4)_6 Mo_7 O_{24} 4H_2O$	1236
,, Nitrate	$NH_4 NO_3$	80
,, Oxalate	$(NH_4)_2 C_2O_4 H_2O$	142
,, Persulphate	$(NH_4)_2 S_2 O_8$	228
,, Sulphide	$NH_4 S$	50
,, Sulphocyanide	$NH_4 CNS$	76
,, Vanadate	$NH_4 VO_3$	117
Amyl, Acetate	$C_7 H_{14} O_2$	130
,, Alcohol	$(CH_3)_2 CH CH_2 CH_2OH$	88
Aniline	$C_6 H_5 NH_2$	93
"Anthion" (Potass. persulphate)		
Antimony, Sulphide	$Sb_2 S_3$	336
Aurantia	$(C_6H_2(NO_2)_3)_2 N NH_4$	456
Aurine	$C (C_6 H_4 OH)_2 C_6 H_4 O$	290
Barium, Bromide	$Ba Br_2 2H_2O$	333
,, Chloride	$Ba Cl_2 2H_2O$	244
,, Iodide	$Ba I_2$	391
,, Nitrate	$Ba (NO_3)_2$	261
,, Peroxide	BaO_2	201
,, Sulphate	$Ba SO_4$	233
Benzole (Benzene)	$C_6 H_6$	78
Borax (*see* Sodium Borate)		
Bromine	Br	80
Cadmium, Bromide	$Cd Br_2 4H_2O$	344
,, Chloride	$Cd Cl_2$	183
,, Iodide	$Cd I_2$	366
Calcium, Carbide	$Ca_2 C$	92
,, Carbonate	$Ca CO_3$	100
,, Chloride (Cryst.)	$Ca Cl_2 6H_2O$	219
,, ,, (Fused)	$Ca Cl_2$	111
,, Hypochlorite	$Ca (O Cl)_2$	153
,, Sulphate	$Ca SO_4 2H_2O$	172
,, Hydroxide (Slaked Lime)	$Ca (OH)_2$	74
Carbon, Bisulphide	$C S_2$	76
Celloidin	$C_{12} H_{16} O_6 (NO_3)_4$	504
Ceric, Sulphate	$Ce (SO_4)_2 4H_2O$	404
Chloral, Hydrate	$C Cl_3 CH (OH)_2$	165·5
Chloroform	$CH Cl_3$	119·5
Chrysoidine	$C_6 H_5 N_2 C_6 H_3 (NH_2)_2$	211·7
Cobalt, Chloride	$Co Cl_2 6H_2O$	238
Copper, Bromide	$Cu Br_2$	223·5
,, Chloride	$Cu Cl_2 2H_2O$	170·5
,, Sulphate	$Cu SO_4 5H_2O$	249·5
Cyanine	$C_{29} H_{35} N_2 I$	544
Dextrine	$(C_6 H_{10} O_5) x$	—
Diamidophenol	$C_6 H_3 OH (NH_2)_2$	124

TABLE OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Edinol*		
Eikonogen†	$C_{10} H_5 (OH) NH_2 SO_2 O Na$	263
Eosine	Na or K Salt of	—
	$C_6 H_4 (CO)_2 O (C_6 H OH X‡)_2$	—
Erythrosine	$C_6 H_4 (CO)_2 O (C_6 H OH X_2‡)_2$	—
Ether	$C_4 H_{10} O$	74
Ferrous and ferric salts (See Iron)		
Formaline	40% sol. of CH_2O	—
Glycerine	$C_3 H_5 (OH)_3$	92
Glycin*	$C_6 H_4 OH NHCH_2 COOH$	167
Gold, chloride yellow	$H Au Cl_4 4H_2O$	412
,, ,, brown	$H Au Cl_4$	340
,, ,, potassium	$K Au Cl_4 2H_2O$	414
,, ,, sodium	$Na Au Cl_4 2H_2O$	398
Hydrogen, peroxide	H_2O_2	34
Hydroquinone	$C_6 H_4 (OH)_2$	110
Iodine	I	127
Iridious chloride	$Ir Cl_3$	299·5
,, tetrachloride	$Ir Cl_4$	335
,, potassium ,,	$K_2 Ir Cl_6$	484
,, sodium ,,	$Na_2 Ir Cl_6$	452
IRON.		
Ferric chloride (dry)	$Fe_2 Cl_6$	325
,, ,, (lump)	$Fe_2 Cl_6 12H_2O$	541
,, ammonia citrate, brown	$4 Fe C_6 H_5 O_7 3 (NH_4)_3 C_6H_5O_7 3 Fe (OH)_3$	—
,, ,, ,, green	$5 Fe C_6H_5O_7 2(NH_4)_3 C_6H_5O_7 NH_4 C_6H_7O_7 2H_2O$	—
,, oxalate	$Fe_2 (C_2 O_4)_3$	376
,, ammonium oxalate	$(NH_4)_3 Fe (C_2 O_4)_3 3H_2O$	428
,, potassium ,,	$K_3 Fe (C_2 O_4)_3 3H_2O$	491
,, sodium ,,	$Na_6 Fe (C_2O_4)_6 11H_2O$	976
Ferrous, chloride (dry)	$Fe Cl_2$	127
,, ,, (cryst.)	$Fe Cl_2 4H_2O$	199
,, oxalate	$Fe C_2 O_4 2H_2O$	180
,, potassium oxalate	$K_2 Fe (C_2 O_4)_2 H_2O$	328
,, sulphate	$Fe SO_4 7H_2O$	278
,, ammonia sulphate	$Fe (NH_4)_2 (SO_4)_2 6H_2O$	392
Lead, acetate	$Pb (C_2 H_3 O_2)_2 3H_2O$	379
,, nitrate	$Pb (NO_3)_2$	331
Lithia, caustic	$Li OH$	24
Lithium, bromide	$Li Br$	87
,, carbonate	$Li_2 CO_3$	74

* Edinol is the hydrochloride of γ-amido-oxy-benzyl-alcohol.

† Eikonogen is the sodium salt of amido-β-naphthol-β-monosulphuric acid.

‡ The X in these formulæ may be bromine, iodine, or chlorine, which elements in other proportions constitute the various commercial dyes.

§ Glycine is γ-oxyphenyl-glycin or γ-oxyphenyl-amido-acetic acid.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQIV. WEIGHT.
Lithium, chloride	Li Cl (Cryst. has $2H_2O$) ...	42·5
„ iodide	Li I	134
Magnesium, chloride	Mg Cl_2	95
„ sulphate	Mg So_4 $7H_2O$	246
Manganese, peroxide	Mn O_2	87
„ sulphate	Mn SO_4 $4H_2O$	225
Mercury	Hg	200
„ bichloride	Hg Cl_2	271
„ iodide	Hg I_2	454
Methol*	$(C_6H_4OH\,NHCH_3\,p)_2\,H_2SO_4$	344
Ortol†	$(C_6H_4OH\,NHCH_3\,p) + C_6H_4(OH)_2\,p$	234
Palladious chloride	Pd Cl_2	177
„ potassium chloride	K_2 Pa Cl_4	326
Para-amidophenol	$C_6H_4NH_2OH$	109
Phenol (see Acid carbolic)		
Platinum per (or bi)chloride	H_2 Pt Cl_6 $6H_2O$	516·4
Potassium, ammonium chromate.	K NH_4 Cr O_4	173
„ bicarbonate	K H CO_3	100
„ bichromate	K_2 Cr_2 O_7	294
„ boro-tartrate	$C_2H_2(OH)_2(CO_2)_2BOK$	214
„ bromide	K Br	119
„ carbonate (dry)	K_2CO_3	138
„ chlorate	K $Cl\,O_3$	122 5
„ chloride	K Cl	74·5
„ chloro-platinite	K_2 Pt Cl_4	413·4
„ chromate	K_2 Cr O_4	194
„ citrate	$K_3C_6H_5O_7\,H_2O$	342
„ cyanide	K C N	65
„ ferricyanide	K_3 Fe $(CN)_6$	329
„ ferrocyanide	K_4 Fe $(CN)_6$ $3H_2O$	422
„ hydrate	K HO	56
„ iodide	K I	166
„ metabisulphite	$K_2S_2O_5$	222
„ nitrate	K NO_3	101
„ nitrite	K NO_2	85
„ oxalate	$K_2C_2O_4\,H_2O$	184
„ percarbonate	$K_2C_2O_6$	198
„ perchlorate	K $Cl\,O_4$	138·5
„ permanganate	$K_2Mn_2O_8$	316
„ persulphate	$K_2S_2O_8$	270
„ sulphocyanide	K C N S	97
Pyrocatechine	$C_6H_4(OH)_2$	110
Rochelle salt	K Na C_4 H_4 O_6 $4H_2O$	282

* Metol is the sulphate of mono-methyl-para-amido-phenol.

† Ortol is a mixture of one molecule each of methyl-ortho-amido-phenol and hydroquinone.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Schlippe's salt	$Na_3\ Sb\ S_4\ 9H_2O$	479
Silver, acetate	$Ag\ C_2\ H_3\ O_2$	167
,, ammonium nitrate	$Ag\ NO_3 + 2NH_3$	204
,, bromide	$Ag\ Br$	188
,, carbonate	$Ag_2\ CO_3$	276
,, chloride	$Ag\ Cl$	143·5
,, citrate	$Ag\ C_6\ H_5\ O_7$	513
,, fluoride	$Ag\ F\ 4H_2O$	199
,, iodide	$Ag\ I$	235
,, nitrate	$Ag\ NO_3$	170
,, nitrite	$Ag\ NO_2$	154
,, oxalate	$Ag_2\ C_2\ O_4$	304
,, oxide	$Ag_2\ O$	224
,, phosphate	$Ag_3\ PO_4$	419
,, sulphate	$Ag_2\ SO_4$	312
,, sulphide	$Ag_2\ S$	248
,, tartrate	$Ag_2\ C_4\ H_4\ O_6$	363·4
Sodium, acetate	$Na\ C_2\ H_3\ O_2\ 3H_2O$	136
,, bicarbonate	$Na\ H\ CO_3$	84
,, bichromate	$Na_2\ Cr_2\ O_7\ 2H_2O$	298
,, bisulphite	$Na\ H\ SO_3$	104
,, borate	$Na_2\ B_4\ O_7\ 10H_2O$	382
,, bromide	$Na\ Br\ 2H_2O$	139
,, carbonate (dry)	$Na_2\ CO_3$	106
,, carbonate (cryst.)	$Na_2\ CO_3\ 10H_2O$	286
,, chloride	$Na\ Cl$	58·5
,, chloro-platinate	$Na_2\ Pt\ Cl_6\ 6H_2O$	560·4
,, citrate	$Na_3\ C_6\ H_5\ O_7\ 5\frac{1}{2}H_2O$	357
,, fluoride	$Na\ F$	42
,, hydrate (caustic)	$Na\ OH$	40
,, hydrosulphite*	$Na\ H\ SO_2$	88
,, hyposulphite†	$Na_2\ S_2\ O_3\ 5H_2O$	248
,, iodide	$Na\ I$	150
,, nitrate	$Na\ NO_3$	85
,, nitro-prusside	$Na_4\ Fe_2\ (CN)_{10}\ (NO)_2\ 4H_2O$	600
,, oxalate	$Na_2\ C_2\ O_4$	134
,, phosphate	$Na_2\ HPO_4\ 12H_2O$	358
,, tribasic phosphate	$Na_3\ PO_4\ 12H_2O$	380
,, sulphide	$Na_2\ S\ 9H_2O$	240
,, sulphite (dry)	$Na_2\ SO_3$	126
,, ,, (cryst.)	$Na_2\ SO_3\ 7H_2O$	252
,, tungstate	$Na_{10}\ W_{12}\ O_{41}\ 28H_2O$	379·8
Strontium, bromide	$Sr\ Br_2$	247·5
,, chloride (dry)	$Sr\ Cl_2$	158·5
,, ,, (cryst.)	$Sr\ Cl_2\ 2H_2O$	194·5

* Called "hyposulphite" by chemists. † Called "thiosulphate" by chemists.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Strontium, iodide	SrI_2	341·5
„ nitrate	$Sr(NO_3)_2$	211·5
Thiocarbamide	$CS(NH_2)_2$	76
Thiosinamine	$CS(NH_2)NHC_3H_5$	116
Thymol	$CH_3C_6H_3OHC_3H_7$	150
Tin (Stannous) chloride	$SnCl_2+2H_2O$	225
Uranium, acetate	$UO_2(C_2H_3O_2)_2\,2H_2O$	426
„ chloride	UO_2Cl_2	343
„ nitrate	$UO_2(NO_3)_2\,6H_2O$	504
Zinc, sulphate	$ZnSO_4\,7H_2O$	287

TABLE OF THE SOLUBILITIES OF THE PRINCIPAL SUBSTANCES USED IN PHOTOGRAPHY.

sol. = *soluble*; v.s = *very soluble*; s.s. = *slightly soluble*; dec. = *decompose*; insol. = *insoluble*.

Name.	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling		
Acetone	...	...	...	
,, sulphite	v.s.	...	...	s.s.
Acid, acetic	...	...	...	
,, benzoic	380	45	·27	1 in 2·75 90%
,, boric	29	2·9	3½	1 in 28 90%
,, carbolic	15		6·6	v.s.
,, chromic (anhydride)	·6	v.s.	169	sol. with decomp.
,, citric	¾	½	130	
,, formic.....	...	...	...	
,, gallic	100	·3	1	1 in 5 90% alcohol 1 in 40 ether.
,, hydriodic	...	...	...	
,, hydrobromic	...	...	...	
,, hydrocyanic	...	...	...	
,, hydrochloric	...	...	...	
,, hydrofluoric	...	...	...	
,, lactic	...	...	...	

Acetone.—(Sp. gr. ·814). boils at 133°F. miscible in all proportions with water, alcohol, and ether. A solvent of resin, fats, camphor, pyroxylin and celluloid.

Acetic Acid.—The "glacial" acid, which is that implied in formulæ unless a weaker acid is directed, solidifies about 50°. Its sp. gr. is 1·055; it boils at 245°F. It is a solvent of gelatine, celluloid, pyroxyline, fats, oils, etc., blisters the skin, strongly absorbs water from the air, and is miscible with water, alcohol, ether, chloroform, and glycerine in all proportions.

Formic Acid.—A colourless liquid of 1·22 sp. gr. (=100% acid), miscible with water and alcohol. Weaker solutions are:—1·20 (90%); 1·18 (80%); 1·15 (65%); 1·12 (50%) and 1·06 (25%).

Hydriodic Acid.—A solution of the gas, HI, and obtainable as strong as sp. gr. 2·0 (=96% HI). Solution of sp. gr. 1.7 contains about 52%; sp. gr. 1.5, about, 43%.

Hydrobromic Acid.—A solution of the gas. HBr., in water. The strongest solution has sp. gr. of 1·78 (=82%) sol. of 1·495 sp. gr. contains 48% HBr.; 1·38, 40%; 1·208, 25%.

Hydrochloric Acid.—A solution of the gas, HCl. in water. The commercial strongest acid has sp. gr. 1·21, and contains about 40% HCl. Impure acid is sold as "spirits of salts."

Hydrocyanic Acid (=Prussic acid).—The strength of the official acid of the British Pharmacopœia is 2%. A 10% acid is obtainable in the chemical trade. Both are the most deadly and dangerous poisons.

Hydrofluoric Acid is a strongly fuming solution of the gas HF.; it is sold of strengths 40% and 55% HF.

Lactic Acid is sold as a colourless syrupy liquid, miscible with water or alcohol. Sp. gr. 1·21. A weaker acid is also sold commercially containing 50% acid.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling.		
Acid nitric	...	...	...	
„ oxalic	9·5	·3	10½	
„ phosphoric	...	...	...	
„ picric	100	...	1	1 in 10 90%, also in ether.
„ pyrogallic	2¼	v.s.	44	sol. also in ether, not in chloroform.
„ salicylic	500	12½	⅕	1 in 3·5, 1 in 2 in ether.
„ sulphuric	...	...	...	
„ sulphurous	...	...	...	
„ tannic	·5	...	20	1 in ·6, nearly insol. in ether.
„ tartaric	¾	⅓	132	
Adurol	...	...	...	
Agar-agar	...	...	...	
Albumen	...	...	...	
Alcohol ethyl	...	...	...	
„ methyl	...	...	...	
Alum, ammonia	8·3	·24	12	insoluble
„ chrome	6	dec.	16	
„ iron ammonia	3	dec.	33	insoluble
„ potash	8	·28	13	insoluble
Aluminium, chloride	¼	v.s.	400	soluble
„ sulphate	1	·09	100	

Nitric Acid.—Strongly corrosive liquid of 1·42 sp. gr. (=71% HNO_3); soluble in water; oxidizes alcohol and other organic solvents.

Phosphoric Acid.—Sold as syrupy liquid, that of 1·75 sp. gr. (=about 90% acid), being intended when "phosphoric acid" is prescribed in formulæ.

Sulphuric Acid.—The commercial strong acid is a thick corrosive liquid of 1·84 sp. gr. (=98% H_2SO_4). It absorbs water rapidly from the air, and, mixed with water, great heat is developed. The acid should always be added to water—not *vice versa*.

Sulphurous Acid.—Solution in water of the gas SO_2; saturated solution of 1·046 is equivalent to 9·5% H_2SO_3, but soon loses strength.

Albumen.—On heating the cold solution to 160° F. the albumen separates in insoluble form. Alcohol similarly coagulates albumen.

Methyl Alcohol (sp. gr. ·814).—The chief constituent of crude "wood spirit," or wood naphtha, in which is usually 10% of acetone.

Ethyl Alcohol forms "absolute alcohol" (sp. gr. ·830 to ·834), which contains from 2 to 5% water. Alcohol containing 16% water is "rectified spirit." "Methylated" spirit consists of rectified spirit *plus* 10% crude wood spirit and ⅛% mineral naphtha, the latter precipitating as a milkiness on addition of water. These various forms of alcohol mix with water, which can be abstracted with dry potassium carbonate.

TABLES OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water.		100 parts of water dissolved at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling.		
Aluminium, sulphocyanide	...	...	...	
Amidol	4	v.s.	24	less sol. in alc. & eth.
Ammonium, bichromate	10	¼	10	1 in 31 absolute alc.
„ bromide	1·4	v.s.	72	
„ carbonate	4	dec.	25	
„ chloride	3	1·4	35	
„ citrate	½	v.s.	200	
„ iodide	·6	v.s.	165	1 in 4 alc., s s. in ether
„ molybdate	2½	dec.	40	
„ nitrate	½	v.s.	200	
„ oxalate	23	2·4	4·3	sol.
„ persulphate	1½	dec.	65	
„ (hydro) sulphide	...	...	...	
„ sulphocyanide	·6	v.s.	160	v.s.
„ vanadate	s.s.	v.s.	...	
Amyl, acetate	...	...	...	
„ alcohol	...	...	...	
Aniline	...	...	...	
Antimony sulphide	ir sol.	...	...	
Aurantia	s.s.	...	...	v.s.; s.s. in ether
Aurine	s.s.	...	...	sol.; also in ether
Barium bromide	·75	·5	133	v.s. in benzine
„ chloride	2·4	1·3	42	insol.
„ iodide	½	v.s.	200	1 in 20 alcohol
„ nitrate	12	3·1	8	insol.
Bromine	31	...	3·2	
Cadmium, bromide	·94	v.s.	106	1 in 3 alc.; 1 in 250 eth.
„ chloride	·71	·67	140	1 in 8 alcohol
„ iodide	1·08	·75	93	1 in 1 alc.; 1 in 3-6 eth.
Calcium, chloride (cryst.)	¼	v.s.	400	
„ „ (fused)	1·4	·65	70	
„ sulphate	380	450	·3	
„ hydroxide	700	1·300	·137	
Ceric sulphate	12	200	8·3	
Chloral hydrate	¼	...	400	1 in 1/5 90%, 1 in 50 carbon bisulphide

Aluminium Sulphocyanide is purchased as a reddish solution of 1·16 sp. gr.

Ammonium Sulphide is sold as a deep yellow solution containing also poly-Sulphides.

Amyl Acetate.—Liquid of sp. gr. ·876, miscible with alcohol and ether, but not with water. A solvent of fats, oils, resin, pyroxyine and celluloid.

Amyl Alcohol, the chief constituent of fusel oil, is not miscible with water.

Aniline (sp. gr. 1·036) is freely miscible with alcohol or ether, but only very slightly with water. It boils at 356° F. and coagulates albumen.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling		
Copper, bromide	v.s.	v.s.	...	
„ chloride	·83	v.s.	121	v.s.; also in ether.
„ sulphate	2½	½	40	
Cyanine	s.s.	...	...	
Diamidophenol	sol.	...	...	
Edinol	sol.	...	...	[or ether.
Eikonogen	25	...	4·2	nearly insol. in alchl.
Eosine	sol.	...	...	insol. in ether
Ether	12	...	8	
Erythrosine	s.s.	...	...	s.s.
Glycerine	...	...	...	
Glycine	...	...	...	
Gold, chloride	v.s.	v.s.	...	
Hydroquinone	17	...	6	
Iodine	insol.	insol.	...	sol.; also in carbon bisulphide
IRON				
Ferric chloride (lump)	v.s.	v.s.	...	
„ „ (dry)	·63	v.s.	160	
„ ammonium citrate (brown)*	4	...	25	
„ „ (green)†	...	...	...	
„ oxalate	...	...	...	
„ ammonium oxalate	2·1	...	·48	
„ potassium „	15	·85	6·6	insol.
„ sodium „	1·69	0·55	60	
Ferrous chloride (dry)	2	v.s.	50	
„ „ (cryst.)	·68	v.s.	147	
„ oxalate	4500	3800	...	
„ potass. oxalate	...	...	...	
„ sulphate	1·43	0·27	70	
„ am. sulphate	3	...	33	
Lead, acetate	1½	0·5	66	1 in 15 alcohol insol. in ether

Ether (called also "sulphuric ether") is very volatile and inflammable. Boils at 95° F. sp. gr. ·722.

Formaline.—A commercial strong solution (40%) of formic aldehyde, CH_2O.

Gelatine becomes swollen in cold water and dissolves in hot. Dissolves in the cold by oxalic, acetic, hydrochloric, and nitric acids, barium chloride and chloral hydrate. Precipitated from its solution in water by alcohol.

Glycerine.—Miscible with water or alcohol. Sp. gr. 1·265.

Iodine dissolves freely also in carbon bisulphide or potassium iodide solution.

Ferric Oxalate is very soluble, over 20%, it is partially reduced to ferrous oxalate on heating the solution to 212°F.

Seven parts of ferrous sulphate correspond with 10 parts ferrous ammonium sulphate.

* 21·7-22·4% iron. † 14 to 15% iron.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold	Boiling		
Lead, nitrate	2	·7	50	
Lithia, caustic	s.s.	...	...	
Lithium, bromide	·7	·4	143	v.s.
,, carbonate	72	138	1·3	
,, chloride	1¼	·8	80	v.s.
,, iodide	·61	·2	164	v.s.
Magnesium, chloride (dry)	1·7	1½	60	
,, sulphate	1	·15	100	
Manganese, sulphate	·8	1	120	insol. in absolute alc.
Mercury, bichloride	16	1·8	6·3	1 in 4·90 %
,, iodide	150	...	·66	
Metol	sol.	...	...	s.s.; also in ether.
Ortol	sol.	...	...	
Para-amido-phenol	10	...	10	1 in 22
Phenol (*see* acid carbolic)				
Potassium, bicarbonate	4	dec.	25	
,, bichromate	10	1	10	
,, borotartrate	¾	v.s.	135	
,, bromide	1½	1	65	1 in 750
,, carbonate (dry)	·9	·61	112	insol.
,, chlorate	17	2	6	insol.
,, chloride	3	1·75	33	
,, chloroplatinite	6	v.s.	17	insol.
,, chromate	2	1·2	50	insol.
,, citrate	·6	v.s.	166	v.s.
,, cyanide	·8	v.s.	122	1 in 9
,, ferricyanide	2½	1.3	40	
,, ferrocyanide	3·4	2	29	insol.; insol. in eth.
,, hydrate	½	v.s.	200	sol.
,, iodide	·7	½	140	1 in 16·90 %
,, metabisulphite	sol.	dec.	...	
,, nitrate	3½	·4	28	
,, nitrite	1	v.s.	100	insol.
,, oxalate	3	v s.	33	
,, percarbonate	15	dec.	6·5	
,, perchlorate	100	5	1	
,, permanganate	16	...	6·25	
,, persulphate	50	dec.	2	insol. in absolute alc.
,, sulphocyanide	·46	v.s.	220	
Pyrocatechin	1¼	v.s.	80	
Rochelle salt	1½	v.s.	66	
Schlippe's salt	3	v.s.	33	

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water.		100 parts water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling		
Silver, acetate	100	...	1	
,, carbonate	insol.	...	...	
,, chlorate	5	2	20	
,, citrate [1]	insol.	...	...	
,, cyanide	insol.	...	...	
,, fluoride [2]	v.s.	v.s.	...	
,, nitrate	·44	·1	227	1 in 26, 90%
,, nitrite	s.s.	...	...	
,, sulphate	87	...	1·15	
,, sulphocyanide	insol.	,,	...	
,, tartrate	insol.	...	...	
Sodium, acetate	2·8	v.s.	36	1 in 50, 90%; insol. in ether
,, bicarbonate	11·3	dec.	8·8	
,, bichromate	1	·6	100	
,, bisulphite	v.s.	...	...	
,, borate	12½	½	8	
,, bromide	1·1	·9	90	1 in 15
,, carbonate (dry)	6	2·2	16·2	
,, ,, (cryst.)	1·56	v.s.	63·2	
,, chloride	3	2½	35	
,, chloroplatinate	sol.	...	...	
,, citrate	sol.	...	...	s.s.
,, fluoride	25	...	4	
,, hydrate (caustic)	v.s.	v.s.	...	
,, hyposulphite	·6	v.s.	170	insol.
,, iodide	·6	·4	166	
,, nitrate	1·1	·6	85	
,, oxalate	35	...	3	
,, phosphate	6·7	1	15	
,, sulphide	v.s.	v.s.	...	
,, sulphite (cryst.)	2·2	1	45	
,, ,, (dry)	4	...	25	
,, tri-basic phosphate	·5	v.s.	20	
,, tungstate	8 to 12	...	...	insol.
,, (meta) vanadate	½	v.s.	200	
Strontium, bromide	1·01	½	100	1 in 30, 90%
,, chloride	1·96	1	51	
,, ,, (cryst.)	1·33	·6	75	
,, iodide	·56	·25	18	
,, nitrate	1·41	1	71	
Thiocarbamide	11	v.s.	9	v.s. also in ether

1. Readily soluble in ammonia and hypo.
2. $AgF.4H_2O$ is almost as soluble as calcium chloride.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
	Cold.	Boiling.		
Thiosinamine	17	...	6	1 in 2 90% ; also in eth.
Thymol	330		·3	1 in 375 90% ; also in [ether.
Tin (stannous), chloride...	1½	v. s.	66	
Uranium, acetate.....	v. s.	v. s.	...	
„ chloride	v. s.	v. s.	...	
„ nitrate	½	v. s.	200	
Zinc, sulphate	·62	·15	161	

PERCENTAGE OF REAL AMMONIA IN SOLUTIONS OF DIFFERENT DENSITIES AT 14° CENTIGRADE.—CARIUS.

Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.
0·8844	36·0	0·9052	27·0	0·9314	18·0	0·9631	9·0
0·8864	35·0	0·9078	26·0	0·9347	17·0	0·9670	8·0
0·8885	34·0	0·9106	25·0	0·9380	16·0	0·9709	7·0
0·8907	33·0	0·9133	24·0	0·9414	15·0	0·9749	6·0
0·8929	32·0	0·9162	23·0	0·9449	14·0	0·9790	5·0
0·8953	31·0	0·9191	22·0	0·9484	13·0	0·9831	4·0
0·8976	30·0	0·9221	21·0	0·9520	12·0	0·9873	3·0
0·9001	29·0	0·9251	20·0	0·9556	11·0	0·9915	2·0
0·9026	28·0	0·9283	19·0	0·9593	10·0	0·9959	1·0

SOLUBILITY OF THE SILVER HALOIDS.

By E. VALENTA.

Solvent.	Concentration.	100 g. of solution can dissolve in grammes.			Remarks.
		Ag Cl.	Ag Br.	Ag I.	
Sodium hyposulphite	1 : 100	0·40	0·35	0·03	The estimations were made at 70° F.
,,	5 : 100	2·00	1·90	0·15	
,,	10 : 100	4·10	3·50	0·30	
,,	15 : 100	5·50	4·20	0·40	
,,	20 : 100	6·10	5·80	0·60	
Ammonium hypcsulphite	1 : 100	0·57	—	—	For bromide and iodide of silver similar results were obtained as with sodium hyposulphite.
,,	5 : 100	1·32	—	—	
,,	10 : 100	3·92	—	—	
Sodium sulphite	10 : 100	0·44	0·04	0·01	
,,	20 : 100	0·95	0·08	0·02	
Ammonium sulphite	10 : 100		traces		
Ammonium carbonate	10 : 100	0·05	—	—	
Ammonia	3%	1·40	—	—	
,,	15%	7·58	—	—	
Magnesium chloride	50 : 100	0·50	—	—	
Potassium cyanide	5 : 100	2·75	6·55	8·23	80° F.
Ammonium sulphocyanide	5 : 100	0·08	0·21	0·02	76° F.
,,	10 : 100	0·54	2·04	0·08	
,,	15 : 100	2·88	5·30	0·13	
Potassium sulphocyanide	10 : 100	0·11	0·73	—	80° F.
Calcium sulphocyanide	10 : 100	0·15	0·53	0.03	
Barium sulphocyanide	10 : 100	0·20	0·35	0·02	
Aluminium sulphocyanide	10 : 100	2·02	4·50	0·02	
Thiocarbamide	10 : 100	0·83	1·87	0·79	80° F.
Thiosinamine	1 : 100	0·40	0·08	0·008	
,,	5 : 100	1·90	0·35	0·05	
,,	10 : 100	3·90	0·72	0·09	

THERMOMETRIC TABLES.

SHOWING THE ASSIMILATION OF THE THERMOMETERS IN USE THROUGHOUT THE WORLD.

Centigrade.	Réaumur.	Fahrenheit.	Centigrade.	Réaumur.	Fahrenheit.
100	80·0	212·0	49	39·2	120·2
99	79·2	210·2	48	38·4	118·4
98	78·4	208·4	47	37·6	116·6
97	77·6	206·6	46	36·8	114·8
96	76·8	204·8	45	36·0	113·0
95	76·0	203·0	44	35·2	111·2
94	75·2	201·2	43	34·8	109·4
93	74·4	199·4	42	33·6	107·6
92	73·6	197·6	41	32·8	105·8
91	72·8	195·8	40	32·0	104·0
90	72·0	194·0	39	31·2	102·2
89	71·2	192·2	38	30·4	100·4
88	70·4	190·4	37	29·6	98·6
87	69·6	188·6	36	28·8	96·8
86	68·8	186·8	35	28·0	95·0
85	68·0	185·0	34	27·2	93·2
84	67·2	183·2	33	26·4	91·4
83	66·4	181·4	32	25·6	89·6
82	65·6	179·6	31	24·8	87·8
81	64·8	177·8	30	24·0	86·0
80	64·0	176·0	29	23·2	84·2
79	63·2	174·2	28	22·4	82·4
78	62·4	172·4	27	21·6	80·6
77	61·6	170·6	26	20·8	78·8
76	60·8	168·8	25	20·0	77·0
75	60·0	167·0	24	19·2	75·2
74	59·2	165·2	23	18·4	73·4
73	58·4	163·4	22	17·6	71·6
72	57·6	161·6	21	16·8	69·8
71	56·8	159·8	20	16·0	68·0
70	56·0	158·0	19	15·2	66·2
69	55·2	156·2	18	14·4	64·4
68	54·4	154·4	17	13·6	62·6
67	53·6	152·6	16	12·8	60·8
66	52·8	150·8	15	12·0	59·0
65	52·0	149·0	14	11·2	57·2
64	51·2	147·2	13	10·4	55·4
63	50·4	145·4	12	9·6	53·6
62	49·6	143·6	11	8·8	51·8
61	48·8	141·8	10	8·0	50·0
60	48·0	140·0	9	7·2	48·2
59	47·2	138·2	8	6·4	46·4
58	46·4	136·4	7	5·6	44·6
57	45·6	134·6	6	4·8	42·8
56	44·8	132·8	5	4·0	41·0
55	44·0	131·0	4	3·2	39·2
54	43·2	129·2	3	2·4	37·4
53	42·4	127·4	2	1·6	35·6
52	41·6	125·6	1	0·8	33·8
51	40·8	123·8	0	0·0	32·0
50	40·0	122·0			

THERMOMETRIC RULES.

The following rules for the rapid conversion of degrees in one system into another will be found useful :—

TO CONVERT CENTIGRADE INTO FAHRENHEIT:
Degrees Centigrade $(\times 9 \div 5) + 32$.
Ex.—80° C. $\times 9 \div 5 = 144 + 32 = 176°$ F.

TO CONVERT CENTIGRADE INTO REAUMUR:
Degrees Centigrade $\times 4 \div 5$.
Ex.—60° C. $\times 4 \div 5 = 48°$ R.

TO CONVERT FAHRENHEIT INTO CENTIGRADE:
(Degrees Fahrenheit.—32) $\times 5 \div 9$.
Ex.—100° F. $- 32 = 68 \times 5 \div 9 = 37{\cdot}8$ C.

TO CONVERT FAHRENHEIT INTO REAUMUR:
(Degrees Fahrenheit—32) $\div 9 \times 4$.
Ex.—95° F. $- 32 = 63 \div 9 \times 4 = 28°$ R.

TO CONVERT REAUMUR INTO CENTIGRADE:
Degrees Réaumur $\times 4 \div 5$.
Ex.—80° R. $\times 5 \div 4 = 100°$ C.

TO CONVERT REAUMUR INTO FAHRENHEIT:
Degrees Réaumur $(\times 9 \div 4) + 32$.
Ex.—16° R. $\times 9 \div 4 = 36 + 32 = 68°$ F.

DISTRIBUTION OF THE COLOURS IN THE SPECTRUM.

(ACCORDING TO LISTING.)

		Wave length.
BROWN	Limit	819·8
	Middle	768·6
RED	Limit	723·4
	Middle	683·2
ORANGE	Limit	647·2
	Middle	614·9
YELLOW	Limit	585·6
	Middle	559·0
GREEN	Limit	534·7
	Middle	512·4
CYAN BLUE	Limit	491·9
	Middle	473·0
INDIGO	Limit	455·5
	Middle	439·2
VIOLET	Limit	424·0
	Middle	409·9
LAVENDER	Limit	396·7
	Middle	384·3
	Limit	372·6

WAVE LENGTHS OF BRIGHT LINES OF ELEMENTS USED IN PLOTTING OUT THE SPECTRUM.

(IN TEN-MILLIONTHS OF A MILLIMETRE ANGSTROM UNITS.)

TABLE I.

Name of line.	Colour.	Salts used.	Wave lengths = λ
Lithium	Red	Lithium chloride or Nitrate ...	6705
„	Orange	„ „ „ „ ...	6102
D	„	Sodium chloride or bicarbonate	5893
"Little b"	Green	Magnesium ribbon	5183
Strontium	Blue	Strontium chloride or metal	4607
Calcium	„	Calcium nitrate or chloride ...	4227
Potassium	Violet	Potassium chloride	4080

Table I. has been drawn up so as to enable any one with nothing more than an ordinary Bunsen gas burner to construct a chart, by means of which the position of any Fraunhofer line in the spectrum may be determined with sufficient accuracy for all photographic purposes. The salts should be dissolved in distilled water so as to form a saturated solution, a narrow loop of copper or iron wire should be wound with fibrous asbestos, and this repeatedly heated in the Bunsen and allowed to cool. The spectroscope should be arranged so as to give a sharp spectrum of the gas flame, the slit of the spectroscope being closed as much as possible; the asbestos, saturated with the salt solution, should be inserted in the flame opposite the slit, slightly below it and below the top of the flame, and then the position of the bright line read off on the scale of the spectroscope. If only one side of the jaws of the spectroscope is movable, it will be found on examination that, on opening the slit, a bright line will broaden, but on one side only, all readings must be taken from the side that does not move. Assuming that a movable scale is used, it is as well to fix the D or sodium line at a given number, say, 5 or 10. The more accurately the scale is divided and the greater the number of the divisions, and the greater the number of lines observed, the more accurate will be the results obtained; but Table I. will give sufficient accuracy to enable anyone to determine the absorption of trichromatic filters or the sensitiveness of colour-sensitised plates.

Table II. will give the data, most easily obtained if a small induction coil is used. A small coil, giving a fat $\frac{1}{2}$ or $\frac{3}{4}$ in. spark and actuated by three bichromate bottles will suffice to show the lines in this table. The hydrogen tube is, of course, of the well-known Plücker or Salet form. The magnesium may be used in twisted spirals of ribbon, but preferably in rod form, and the rods should be filed to comparatively sharp points. The constricted portion of the vacuum tube and the points of the magnesium rod should be

placed parallel to and not at right angles to the slit, thus giving more brilliant illumination. In photographing the spectra, obtained as above, it is advisable to use a sliding dark slide, so that several spectra can be obtained on one plate, but care should be taken to wedge the plate firmly so that it cannot shift; and with each exposure the scale should be impressed overlapping the spectrum.

It is as well to point out that in most cases a faint continuous spectrum will be observed or photographed, particularly if the slit is at all widely opened, but the lines can be easily distinguished. When burning magnesium, this continuous spectrum is fairly brilliant, but the principal line λ 518.3 is easily seen; close to this, on the blue side, will be seen a very brilliant and wide band, due to the incandescent MgO, the edge of this band towards the red has the wave length λ 5,007. The spark spectrum of magnesium is always very clear and sharp, and is characterised by the absence of the continuous spectrum, and λ 4,481 is very brilliant and broad, and when photographed the middle should be measured.

TABLE II.

C	Red	Hydrogen tube	6563
"Little b"	Green	Magnesium rod	5183
F	Bluish-green	Hydrogen tube	4861
Magnesium	Blue	Magnesium rod	4481
G	,,	Hydrogen tube	4308
"Little h"	,,	,, ,, ...	4102

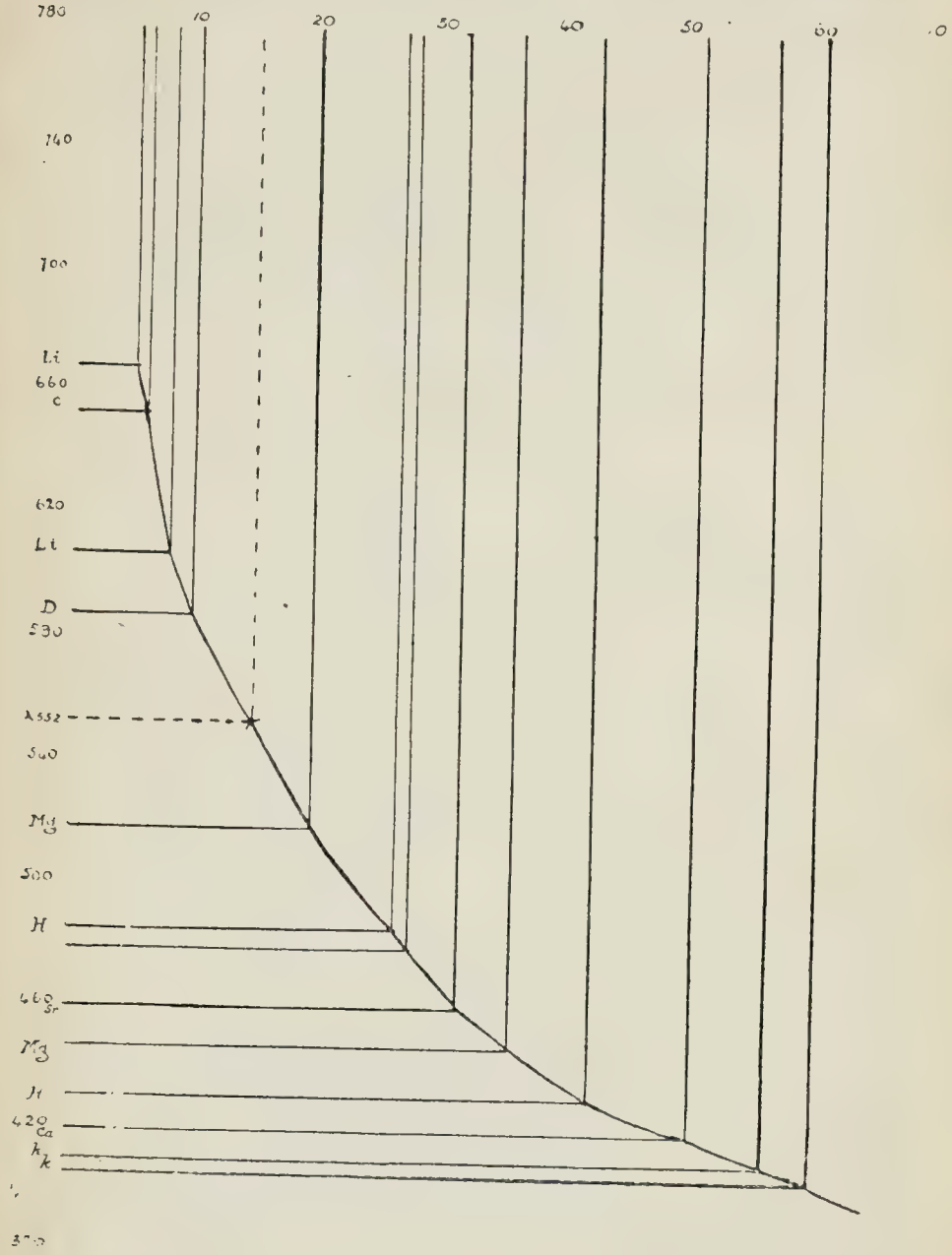
In order to find the wave length of any observed and unknown line, it is necessary to use an interpolation chart, and for this purpose squared paper should be obtained from any chemical apparatus dealer, and along the longer side should be marked the wave lengths, ranging from λ 4,000 to λ 7,800; on one, or both sides, should be marked the numbers of the scale. A straight line should be drawn from the wave length till it cuts another straight line, drawn at right angles, from the number of the scale. If this is done (as in the diagram herewith), for all the lines found as described above, and the points of intersection of the lines be joined up by a curve, the chart will be complete.

To find the wave length of any strange line, it is only necessary to rule a straight line from the scale number till it cuts the curve, when another, drawn at right angles to the base of wave lengths, will give the required reading. In the chart a hypothetical line was observed at Scale No. 15, and the dotted line was drawn till it cut the curve in X, and from this another dotted line was dropped, and the wave length found to be λ 552.

It is obvious that the larger the ruled paper (and several sheets may be mounted on a card) the greater will be the extension of the wave length scale and the empirical scale, and consequently the more accurate the reading.

For those requiring great accuracy of reading and a much greater

number of lines, reference should be made to "An Introduction to the Study of Spectrum Analysis" (Watts): "Beiträge zur Photochemie



und Spectralanalyse" (Eder and Valenta), and "Studies of Gases" (Travers); or to Baly's "Spectroscopy" (Longman.)

COMPARATIVE TABLE.

(SHEWING THE DIFFERENT SPEEDS AND COLOUR SENSITIVENESS OF VARIOUS PLATES TO DIFFERENT LIGHTS).—EDER.

Kind of plates.	Inertia.		Relative Sensitiveness $\frac{\text{Blue}}{\text{Yellow}}$.		
	Benzine light. 1m. distant.	By daylight (equal to an ordinary plate)	Direct Benzine light. 0.3m. distant.	Reflected from white paper.	
	in Scheiner degrees.			Diffused daylight.	Magnesium light.
Commercial ortho (to be used without a screen)					
Maker A	19°	11–12°	$\frac{1}{1\cdot7} - \frac{1}{5\cdot6}$	$\frac{2\cdot7}{1}$	$\frac{1\cdot3 - 1\cdot6}{1}$
„ B	13°	11–12°	$\frac{1}{1\cdot3}$	$\frac{6-7}{1}$	$\frac{4\cdot3-5}{1}$
„ C	15°	9–10°	$\frac{1}{3}$	$\frac{2\cdot8}{1}$	$\frac{1\cdot35}{1}$
„ D (erythrosine plate with blue sensitiveness strongly depressed with yellow dye)	14°	7–8°	$\frac{1}{8}$	$\frac{1\cdot2 - 1\cdot3}{1}$	—
Inferior orange sensitive plate	10°	7°	$\frac{21-2\cdot4}{1}$	$\frac{60}{1}$	$\frac{20}{1}$
Medium panchromatic (emulsion sensitised)	17°	10–11°	$\frac{1}{21}$	$\frac{7\cdot1}{1}$	—
Good panchromatic plate (bathed with orthochrome, ethyl red or pinachrome)	18–19°	11°	$\frac{1}{4} - \frac{1}{5}$	$1 - \frac{1}{1\cdot3}$	—

FREEZING MIXTURES.

THE following mixtures will be found useful where ice is not readily obtainable—

	Ingredients.	Parts by Weight.	The Temperature at starting being 50° Fahr. the thermometer sinks.	Diminution of Temperature.
1	Water	1	From +50° to + 4°	46° Fahr.
	Nitrate of ammonia	1		
2	Water	16	„ +50° „ +10°	40° „
	Saltpetre	5		
	Chloride of ammonium (sal ammoniac)	5		
3	Water	1	„ +50° „ + 7°	43° „
	Nitrate of ammonia	1		
	Carbonate of soda	1		
4	Snow	2	„ 32° „ — 5°	37° „
	Chloride of sodium	1		
5	Snow	2	„ +32° „ – 50°	82° „
	Crystallised chloride of calcium	3		
6	Crystallised sulphate of soda	8	„ + 0° „ 0°	50° „
	Hydrochloric Acid	5		

EXPOSURE TABLES.

(Eder.)

The length of exposure depends upon the colour and the illumination of the object, on the ratio aperture of the lens, the brightness of the light and the sensitiveness of the plate.

The following table gives the exposures for slow plates of about 5 Hurter and Driffield, in bright sunshine from 9 a.m. to 3 p.m. during the months of April, May, June, July, and August. From sunrise to 9 a.m., and from 3 p.m. to sunset, the exposures must be increased. During March and September, from 10 a.m. to 2 p.m., the exposures given should be increased one and a half times, and during the remaining months—January, February, October, November, and December—the exposures should be approximately doubled.

As a rule, in diffused daylight (not sunlight), the exposure should be twice as long as in direct sunlight.

An example will make this table clear. If a lens is used working at an aperture of $f/32$, this aperture is found in the first column, and the exposure for an open landscape will be $\frac{1}{4}$ second if the light is good and in the middle of the day. If $f/64$ is used, the exposure would be one second. If, in the last case, there were dark foliage in the foreground, the exposure would be prolonged to six seconds.

If a plate of higher speed is used, the exposure must be decreased in direct ratio to the speed of the plate, thus a plate of 100 H. and D. will require twenty times less exposure.

Ratio Aperture.	Sea and Sky.	LANDSCAPES.				INTERIORS.				PORTRAITS.			
		Open Landscape.	Landscape with dense foliage in foreground	Under trees.		Bright Interiors.		Dark Interiors.		Portraits in bright diffused light outdoors.	Portraits in good studio light.	Portraits in room.	
	sec.	sec.	sec.	min.	sec.	min.	sec.	hrs.	min.	sec.	sec.	min.	sec.
F/5·6	$\frac{1}{400}$	$\frac{1}{125}$	$\frac{1}{250}$	—	4	—	4	—	1	$\frac{1}{12}$	$\frac{3}{8}$	—	$1\frac{1}{2}$
F/8	$\frac{1}{200}$	$\frac{1}{60}$	$\frac{1}{100}$	—	8	—	8	—	2	$\frac{1}{6}$	$\frac{3}{4}$	—	3
F/11·3	$\frac{1}{100}$	$\frac{1}{32}$	$\frac{1}{50}$	—	16	—	16	—	4	$\frac{1}{3}$	$1\frac{1}{2}$	—	6
F/16	$\frac{1}{50}$	$\frac{1}{16}$	$\frac{2}{25}$	—	32	—	32	—	8	$\frac{2}{3}$	3	—	12
F/22·6	$\frac{1}{25}$	$\frac{1}{8}$	$\frac{4}{25}$	1	4	1	4	—	16	$1\frac{1}{3}$	6	—	24
F/32	$\frac{1}{12}$	$\frac{1}{4}$	$1\frac{1}{2}$	2	8	2	8	—	32	$2\frac{2}{3}$	12	—	48
F/45	$\frac{1}{6}$	$\frac{1}{2}$	3	4	16	4	16	1	—	5	24	1	36
F/64	$\frac{1}{3}$	1	6	8	32	8	32	2	—	10	48	3	12

EXPOSURE TABLE FOR MOVING OBJECTS.

The smaller the object appears on the ground glass of the camera, the smaller will be the visible movement of the same. As an object appears smaller (1) the further it is from the lens, and (2) the shorter the focus of the lens, it necessarily follows that both these factors have an influence on the visible movement of the image. On the other hand, it is obvious that to obtain a sharp image, the shorter must be the exposure, the greater the visible displacement of the image during a given time. The following table is based on these facts:—

Distance of object from Lens.	Rate of movement per second.		
	1 ft.	5 ft.	10 ft.
100 times the focus of lens	Exposure. $\frac{1}{100}$ sec.	$\frac{1}{500}$ sec.	$\frac{1}{1000}$ sec.
500 " " " " "	$\frac{1}{200}$ "	$\frac{1}{100}$ "	$\frac{1}{200}$ "
1000 " " " " "	$\frac{1}{100}$ "	$\frac{1}{50}$ "	$\frac{1}{100}$ "

The use of this table is simple: if a horse is moving at the rate of 5 ft. per second, at a distance of 1,000 times the focus of the lens away, the image will be sufficiently sharp if the exposure is 1-50th sec. If, however, the horse is only 100 times the focus distant (i.e., 10 times nearer), then the exposure should be only 1-500th sec. (i.e., 10 times shorter). From this it follows that it is more difficult to obtain good instantaneous pictures the nearer the object is and the longer the focus of the lens. If a moving object is taken instantaneously, the image will be sufficiently sharp when the displacement of the outlines of the same does not amount to more than 1-250th of an inch.

A TABLE OF POISONS AND ANTIDOTES. Compiled by Mr. J. V. ELSDEN.

	Poisons.	Remarks.	Characteristic Symptoms.	Antidote.
Vegetable Caustic Acid. Alkalies.	OXALIC ACID, including POTASSIUM OXALATE	1 drachm is the smallest fatal dose known.	Hot burning sensation in throat and stomach; vomiting, cramps, and numbness.	Chalk, whiting, or magnesia suspended in water. Plaster or mortar can be used in emergency. Vinegar and water.
	AMMONIA POTASH SODA	Vapour of ammonia may cause inflammation of the lungs.	Swelling of tongue, mouth, and fauces; often followed by stricture of the œsophagus.	
Metallic Salts.	MERCURIC CHLORIDE	3 grains the smallest known fatal dose.	Acrid, metallic taste, constriction and burning in throat and stomach, followed by nausea and vomiting.	White and yolk of raw eggs with milk. In emergency, flour paste may be used.
	ACETATE OF LEAD	The sub-acetate is still more poisonous.	Constriction in the throat and at pit of stomach; crampy pains and stiffness of abdomen; blue line round the gums.	Sulphates of soda or magnesia Emetic of sulphate of zinc.
	CYANIDE OF POTASSIUM	*a*. Taken internally, 3 grs. fatal.	Insensibility, slow gasping respiration, dilated pupils, and spasmodic closure of the jaws.	No certain remedy; cold affusion over the head and neck most efficacious.
		b. Applied to wounds and abrasures of the skin.	Smarting sensation.	Sulphate of iron should be applied immediately.
	BICHROMATE OF POTASSIUM	*a*. Taken internally.	Irritant pain in stomach and vomiting.	Emetics and magnesia, or chalk.
		b. Applied to slight abrasions of the skin.	Produces troublesome sores and ulcers.	
	NITRATE OF SILVER		Powerful irritant.	
Concentrated Mineral Acids.	NITRIC ACID	2 drachms have been fatal. Inhalation of the fumes has also been fatal.	Corrosion of windpipe, and violent inflammation.	Common salt to be given immediately, followed by emetics. Bicarbonate of soda, or carbonate of magnesia or chalk, plaster of the apartment beaten up in water.
	HYDROCHLORIC ACID SULPHURIC ACID	½ ounce has caused death. 1 drachm has been fatal.		
	ACETIC ACID, concentrated, has as powerful an effect as the mineral acids.			
	IODINE	Variable in its action; 3 grains have been fatal	Acrid taste, tightness about the throat, vomiting.	Vomiting should be encouraged and gruel, arrowroot, and starch given freely.
	ETHER	When inhaled.	Effects similar to chloroform.	Cold affusion and artificial respiration.
	PYROGALLOL	2 grains sufficient to kill a dog.	Resembles phosphorous poisoning	No certain remedy. Speedy emetic desirable.

EQUATIONS RELATING TO FOCI, &c.

THE following simple optical formulæ and calculations, worked out by Mr. J. A. C. Branfil, will prove useful in many branches of photography, especially where several lenses of varying foci are in constant use for a variety of purposes:—

Let p = Principal focus.
F = Greater conjugate do.
f = Lesser do. do.
$D = F + f$ = distance of image from object.
r = Ratio of any dimension in original to the same dimension in copy (in case of reduction), or *vice versâ* (in case of enlargement).
a = Effective diameter of diaphragm.
U.S.No. = 'Uniform System' No. of do.
x = Comparative exposure required.

Then
$$p = D \times \frac{r}{(r+1)^2} = \frac{F f}{D} = \frac{F}{r+1} = \frac{r f}{r+1}$$
$$F = p(r+1) = \frac{p f}{f-p} = r f = \frac{r D}{r+1}$$
$$f = p \times \frac{(r+1)}{r} = \frac{p F}{F-p} = \frac{D}{r+1} = \frac{F}{r}$$
$$D = p \times \frac{(r+1)^2}{r} \quad f(r+1) = p\left(2 + r + \frac{1}{r}\right)$$
$$r = \frac{F-p}{p} = \frac{p}{f-p} = \frac{F}{f}$$
$$\text{U. S. No.} = \frac{p^2}{16\,a^2}$$
$$x = \frac{f^2}{16\,a^2} = \frac{p^2}{16\,a^2} \times \frac{(r+1)^2}{r^2}$$

N.B.—For ordinary landscape work, where r is greater than 20, x may be taken as $\frac{p^2}{16\,a^2}$

NOTE.—In case the above may not be clear to some photographers, the following rules may be better understood:—

To find the principal focus of a lens (p), focus a near object in the camera, and measure the distance between it and the ground-glass (D); next find the proportion which any dimension in the object bears to the same dimension on the ground-glass (r). Thus, if the original dimension be four times as large as its reproduction, we say that r equals (=) 4. Multiply D by r, and divide the product by the square of a number greater by one than r, or $(r+1)$. This rule was lately published by Mr. Debenham.

To find the lesser conjugate focus (f) (if p and r are known) multiply p by the sum of $r+1$, and divide the product by r. Or divide D by $r+1$.

To find the greater conjugate focus (F) multiply p by $r+1$. Or multiply f by r.

To find D (the distance which the ground-glass should be from the object to be copied in order to get a given value for r) multiply p by the sum of $r + \frac{1}{r} + 2$.

To find r divide $F-p$ (the difference between F and p) by p. Or divide p by $f-p$. Or divide F by f.

To find x divide the square of f by 16 times the square of a (the diameter of aperture to lens).

For example: focus an object which is five inches high, so that it is one inch high on the ground glass; thus we know that $r = 5$. Next measure the distance between the object and the ground glass (D), which is found to be 45 inches.

Then $p = 45 \times$ (multiplied by) $5 \div$ (divided by) $6 \times 6 = 6\frac{1}{4}$ inches.
$f = 6\frac{1}{4} \times 6 \div 5 = 7\frac{1}{2}$ inches. Or $f = 45 \div 6 = 7\frac{1}{2}$ inches.
$F = 6\frac{1}{4} \times 6 = 37\frac{1}{2}$ inches. Or $F = 7\frac{1}{2} \times 5 = 37\frac{1}{2}$ inches.
$D = 6\frac{1}{4} \times (5 + \frac{1}{5} + 2) = 6\frac{1}{4} \times 7\frac{1}{5} = 45$ inches.
$r = (37\frac{1}{2} - 6\frac{1}{4}) \div 6\frac{1}{4} = 5$. Or $r = 6\frac{1}{4} \div (7\frac{1}{2} - 6\frac{1}{4}) = 5$.

APPROXIMATE INFINITY FOR LENSES OF VARIOUS FOCAL LENGTHS.

By C. Welborne Piper, from "The First Book of the Lens."

FOCAL LENGTH, INCHES.	DISTANCE OF FOCUSSING-SCREEN BEHIND PRINCIPAL FOCUS.			
	$\frac{1}{100}$ in.	$\frac{1}{250}$ in.	$\frac{1}{500}$ in.	$\frac{1}{1000}$ in.
1	3 yds.	7½ yds.	15 yds.	30 yds.
2	11 ,,	28 ,,	55 ,,	110 ,,
3	25 ,,	63 ,,	125 ,,	250 ,,
4	45 ,,	113 ,,	225 ,,	450 ,,
5	70 ,,	175 ,,	350 ,,	700 ,,
6	100 ,,	250 ,,	500 ,,	1000 ,,
7	136 ,,	340 ,,	680 ,,	1360 ,,
8	178 ,,	¼ mile.	½ mile	1 mile
9¾	264 ,,	660 yds.	¾ ,,	1½ miles
11¼	351 ,,	½ mile	1 ,,	2 ,,
12½	434 ,,	1085 yds.	1¼ miles	2½ ,,
13¾	525 ,,	¾ mile	1½ ,,	3 ,,
16	700 ,,	1 ,,	2 ,,	4 ,,
17¾	875 ,,	1¼ miles	2½ ,,	5 ,,
19½	1056 ,,	1½ ,,	3 ,,	6 ,,
21	1225 ,,	1¾ ,,	3½ ,,	7 ,,
22½	1406 ,,	2 ,,	4 ,,	8 ,,
24	1600 ,,	2¼ ,,	4½ ,,	9 ,,
25	1 mile	2½ ,,	5 ,,	10 ,,
28	1¼ miles	3¼ ,,	6½ ,,	13 ,,
30	1½ ,,	3¾ ,,	7½ ,,	15 ,,
33	1¾ ,,	4½ ,,	9 ,,	18 ,,
35	2 ,,	5 ,,	10 ,,	20 ,,

By focussing accurately on distances not less than those given, we ensure that the focussing-screen is within $\frac{1}{100}$, $\frac{1}{250}$, $\frac{1}{500}$ or, $\frac{1}{1000}$ in, from the true principal focus.

TABLE FOR ENLARGEMENTS.

Focus of Lens, inches.	TIMES OF ENLARGEMENT AND REDUCTION.							
	1 inches.	2 inches.	3 inches.	4 inches.	5 inches.	6 inches.	7 inches.	8 inches.
3	6 6	9 4½	12 4	15 3¾	18 3⅗	21 3½	24 3 3/7	27 3⅜
3½	7 7	10½ 5¼	14 4⅔	17½ 4⅜	21 4⅕	24½ 4 1/2	28 4	31½ 3 15/16
4	8 8	12 6	16 5⅓	20 5	24 4⅘	28 4⅔	32 4 4/7	36 4½
4½	9 9	13½ 6¾	18 6	22½ 5⅝	27 5⅖	31½ 5¼	36 5⅐	40½ 5 1/8
5	10 10	15 7½	20 6⅔	25 6¼	30 6	35 5⅚	40 5 5/7	45 5⅝
5½	11 11	16½ 8¼	22 7⅓	27½ 6 7/8	33 6⅗	38½ 6 1/2	44 6 2/7	49½ 6 3/16
6	12 12	18 9	24 8	30 7½	36 7⅕	42 7	48 6 6/7	54 6¾
7	14 14	21 10½	28 9⅓	35 8¾	42 8⅖	49 8⅛	56 8	63 7⅞
8	16 16	24 12	32 10⅔	40 10	48 9⅗	56 9⅓	64 9 1/7	72 9
9	18 18	27 13½	36 12	45 11¼	54 10⅘	63 10½	72 10 2/7	81 10⅛
10	20 20	30 15	40 13⅓	50 12½	60 12	70 11⅔	80 11 3/7	90 11¼
11	22 22	33 16½	44 14⅔	55 13¾	66 13⅕	77 12 5/6	88 12 4/7	99 12⅜
12	24 24	36 18	48 16	60 15	72 14⅖	84 14	96 13 5/7	108 13½

THE object of this table is to enable any manipulator who is about to enlarge (or reduce) a copy any given number of times, to do so without troublesome calculation. It is assumed that the photographer knows exactly what the focus of his lens is, and that he is able to measure accurately from its optical centre. The use of the table will be seen from the following illustration :—A photographer has a *carte* to enlarge to four times its size, and the lens he intends employing is one of six inches equivalent focus. He must, therefore, look for 4 on the upper horizontal line, and for 6 in the first vertical column, and carry his eye to where these two join, which will be at 30—7½. The greater of these is the distance the sensitive plate must be from the centre of the lens ; and the lesser, the distance of the picture to be copied. To *reduce* a picture any given number of times the same method must be followed, but in this case the greater number will represent the distance between the lens and the picture to be copied ; the latter, that between the lens and the sensitive plate. This explanation will be sufficient for every case of enlargement or reduction.

RELATIVE EXPOSURES FOR VARYING PROPORTIONS OF IMAGE TO THE ORIGINAL.

(W. E. Debenham's Table.)

To find the relative exposure, add one to the number of times that the length of the original is contained in the length of the image, and square the sum. This will give the figure found in the third column of the annexed table.

As examples: suppose a copy is wanted having twice the linear dimensions of the original. Take the number 2, add 1 to it, and square the sum, $3^2=9$. Again, if a copy is to be of eight times the linear dimensions of the original, take the number 8, add 1, and square the sum, $9^2=81$. Copies repectively twice and eight times the size (linear) of the original will thus require relative exposures of 9 and 81—*i.e.*, the latter will require nine times the exposure of the former.

It is convenient to have a practical standard for unity. An image of the same size as the original is a familiar case, and serves as such standard. By dividing the figures in the third column by four, we get at the figures in the last column, which represent the exposure required for varying degrees of enlargement or reduction, compared with the exposure for a copy of the same size.

The table is carried up to enlargements of thirty diameters; that is about the amount required for enlarging a *carte-de-visite* to life size.

The exposures required in reductions do not vary at all to the same extent that they do in enlargements. It has, therefore, not been thought necessary to fill in the steps between images of $\frac{1}{10}$ and $\frac{1}{20}$, and between $\frac{1}{20}$ and $\frac{1}{30}$ of the size of the original. Beyond $\frac{1}{30}$ there is scarcely any perceptible difference in the exposure until disturbance comes in from another cause, a considerable distance of illuminated atmosphere (haze or fog) intervening.

The figures in the second column will also serve as a table for distances from the lens to the plate and to the original, all that is necessary being to multiply by the principal focus of the lens in use. In the case of enlargements the figures less than 2 must be multiplied to get the distance from the original to the lens, and the figures greater than 2 or the distance from lens to image. For reductions the figures less than 2, multiplied by the principal focus of the lens, yield the distance from lens to plate; and the figures higher than 2, similarly multiplied, give the distance of original from lens.

With single "view lenses" the size of the effective aperture is different on the two sides of the lens, and the rapidity of the lens therefore varies with the side presented to the original. Therefore exposures can only be compared by the table when the same side of the lens is towards the original. The aperture also varies with the distance of the original, and the table does not accurately apply when enlarging. When reducing with a single lens the table gives approximately accurate results. It only applies accurately in all circumstances with doublets.

Proportion of image to original (linear).	Distance of image from lens* in terms of principal focus.	Proportionate exposures.	Exposures proportioned to that required for copying same size.
$\frac{1}{30}$	$1\frac{1}{30}$	1·07	·27
$\frac{1}{20}$	$1\frac{1}{20}$	1·10	·28
$\frac{1}{10}$	$1\frac{1}{10}$	1·21	·3
$\frac{1}{8}$	$1\frac{1}{8}$	1·27	·31
$\frac{1}{6}$	$1\frac{1}{6}$	1·36	·34
$\frac{1}{4}$	$1\frac{1}{4}$	1·56	·39
$\frac{1}{2}$	$1\frac{1}{2}$	2·25	·56
$\frac{3}{4}$	$1\frac{3}{4}$	3·06	·76
(Same size) 1	2	4	1
2	3	9	2·25
3	4	16	4
4	5	25	6·25
5	6	36	9
6	7	49	12·25
7	8	64	16
8	9	81	20·25
9	10	100	25
10	11	121	30·25
11	12	144	36
12	13	169	42·25
13	14	196	49
14	15	225	56·25
15	16	256	64
16	17	289	72·25
17	18	324	81
18	19	361	90·25
19	20	400	100
20	21	441	110·25
21	22	484	121
22	23	529	132·25
23	24	576	144
24	25	625	156·25
25	26	676	169
26	27	729	182·25
27	28	784	196
28	29	841	210·25
29	30	900	225
30	31	961	240·25

* With a double lens it is usually sufficient to measure from the position of the diaphragm plate.

TABLE OF VIEW-ANGLES.

By Clarence B. Woodman, Ph.D.

Divide the Base* of the Plate by the Equivalent Focus of the Lens

If the quotient is	The angle is	If the quotient is	The angle is	If the quotient is	The angle is
	Degrees.		Degrees		Degrees.
·282	16	·748	41	1·3	66
·3	17	·768	42	1·32	67
·317	18	·788	43	1·36	68
·335	19	·808	44	1·375	69
·353	20	·828	45	1·4	70
·37	21	·849	46	1.427	71
·389	22	·87	47	1·45	72
·407	23	·89	48	1·48	73
·425	24	·911	49	1·5	74
·443	25	·933	50	1·53	75
·462	26	·954	51	1·56	76
·48	27	·975	52	1·59	77
·5	28	1·	53	1·62	78
·517	29	1·02	54	1·649	79
·536	30	1·041	55	1·678	80
·555	31	1·063	56	1·7	81
·573	32	1·086	57	1·739	82
·592	33	1·108	58	1·769	83
·611	34	1·132	59	1·8	84
·631	35	1·155	60	1·833	85
·65	36	1·178	61	1·865	86
·67	37	1·2	62	1·898	87
·689	38	1·225	63	1·931	88
·708	39	1·25	64	1·965	89
·728	40	1·274	65	2·	90

Example.—Given a lens of 13 inches equivalent focus; required the angle included by it on plate $3\frac{1}{4} \times 4\frac{1}{4}$.

Dividing 4·23 by 13, we have as quotient ·327—midway between the decimals ·317 and ·335 of our table; therefore the required angle is 18° 30′.

* More accurately the diagonal of the plate, inasmuch as the field of the lens is circular and if the corners of the plate are to be covered the angle embraced by the lens should be sufficient to cover the diagonal of the plate.

The lengths of the diagonals of the plates most commonly used are:—

$3\frac{1}{4} \times 3\frac{1}{4}$	diagonal	4·6	inches.	$7\frac{1}{2} \times 5$	diagonal	9·0	inches
$3\frac{1}{4} \times 4\frac{1}{4}$	,,	5·3	,,	$6\frac{1}{2} \times 8\frac{1}{2}$	,,	10·7	,,
4 × 5	,,	6·4	,,	8 × 10	,,	12·8	,,
$4\frac{3}{4} \times 6\frac{1}{2}$	,,	8·0	,,	10 × 12	,,	15·6	,,
7 × 5	,,	8·6	,,	12 × 15	,,	19·2	,,

MR. E. M. NELSON'S TABLE OF DISTANCES FOR LANTERN PROJECTION.

DISTANCE OF PROJECTION LENS FROM SCREEN, MASK BEING THREE INCHES.

Foci	4½	5	5½	6	7	8	9	10	11	12	14	15	16	18
Disc.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
5	7 10½	8 9	9 7½	10 6	12 3	14 0	15 9	17 6	19 3	21	24 6	26 3	28 0	31 6
6	9 4½	10 5	11 5½	12 6	14 7	16 8	18 9	20 10	22 11	25	29 2	31 3	33 4	37 6
7	10 10½	12 1	13 3½	14 6	16 11	19 4	21 9	24 2	26 7	29	33 10	36 3	38 8	43 6
8	12 4½	13 9	15 1½	16 6	19 3	22 0	24 9	27 6	30 3	33	38 6	41 3	44 0	49 6
9	13 10½	15 5	16 11½	18 6	21 7	24 8	27 9	30 10	33 11	37	43 2	46 3	49 4	55 6
10	15 4½	17 1	18 9½	20 6	23 11	27 4	30 9	34 2	37 7	41	47 10	51 3	54 8	61 6
11	16 10½	18 9	20 7½	22 6	26 3	30 0	33 9	37 6	41 3	45	52 6	56 3	60 0	67 6
12	18 4½	20 5	22 5½	24 6	28 7	32 8	36 9	40 10	44 11	49	57 2	61 3	65 4	73 6
13	19 10½	22 1	24 3½	26 6	30 11	35 4	39 9	44 2	48 7	53	61 10	66 3	70 8	79 6
14	21 4½	23 9	26 1½	28 6	33 3	38 0	42 9	47 6	52 3	57	66 6	71 3	76 0	85 6
15	22 10½	25 5	27 11½	30 6	35 7	40 8	45 9	50 10	55 11	61	71 2	76 3	81 4	91 6
16	24 4½	27 1	29 9½	32 6	37 11	43 4	48 9	54 2	59 7	65	75 10	81 3	86 8	97 6
18	27 4½	30 5	33 5½	36 6	42 7	48 8	54 9	60 10	66 11	73	85 2	91 3	97 4	109 6
20	30 4½	33 9	37 1½	40 6	47 3	54 0	60 9	67 6	74 3	81	94 6	101 3	108 0	121 6
25	37 10½	42 1	46 3½	50 6	58 11	67 4	75 9	84 2	92 7	101	117 10	126 3	134 8	151 6
30	45 4½	50 5	55 5½	60 6	70 7	80 8	90 9	100 10	110 11	121	141 2	151 3	161 4	181 6
35	52 10½	58 9	64 7½	70 6	82 3	94 0	105 0	117 6	129 3	141	164 6	176 3	188 0	211 6
40	60 4½	67 1	73 9½	80 6	93 11	107 4	120 9	134 2	147 7	161	187 10	201 3	214 8	241 6
45	67 10½	75 5	82 11½	90 6	105 7	120 8	135 9	150 10	165 11	181	211 2	226 3	241 4	271 6
50	75 4½	83 9	92 1½	100 6	117 3	134 0	150 9	167 6	184 3	201	234 6	251 3	268 0	301 6

CONTINENTAL STOPS AND THEIR U.S. EQUIVALENTS.

MR. EDWARD M. NELSON says: "Photographers are frequently troubled by the Continental nomenclature of the stops, and wish to know the U.S. equivalents for them. The method of finding this out is very simple. All that is necessary is to divide *f*-4 by the ratio to be converted, and square the result. Example: required the U.S. equivalent of *f*-9:—

$$\frac{f}{4} \div \frac{f}{9} = \frac{f}{4} \times \frac{9}{f} = 2{\cdot}25;$$

the square of 2·25 is 5·06, the U.S. number required. The following is a table of the Continental stops more commonly met with, and also the Continental values of the U.S. ratios:—

Ratios. *f* divided by	Continental Values.	U.S. Values.	Ratios. *f* divided by	U.S. Values.	Continental Values.
4·5	512	1·26	2·828	·5	1250
6·3	256	2·48	4	1	625
7	204	3 06	5·66	2	312
7·2	193	3·24	8	4	156
7·7	168	3·71	11·31	8	78
9	128	5·06	16	16	39
12·5	64	9·77	22·6	32	20
14·5	47	13	32	64	9·77
18	32	20	45·3	128	4·88
25	16	39	64	256	2·44
36	8	81	90·5	512	1·22
50	4	156	...	...	...
71	2	315	...	...	...
100	1	625	...	...	...

"To find the *f* ratio for the U.S. values, multiply the U.S. value by 16 and the square root of the product is the required ratio. Example: What is the ratio of U.S. 32? 32 multiplied by 16 is 512, the square root of this is 22 6, the ratio required.

"To find the *f* ratio for the Continental stops, multiply the reciprocal of the square root of the Continental value by 100. Example: What is the *f* ratio of the Continental value 16? The square root of 16 is 4, the reciprocal of 4 is ·25, which, multiplied by 100, is 25, the ratio required.

"*Note.*—The Continental ratios of 512, 256, and 8, ought to be 4·4, 6·25, and 35, respectively. The figures in the list are those extracted from Continental opticians' catalogues."

TABLE OF DISTANCES FOR AN OBJECT OF SIXTY-EIGHT INCHES HEIGHT.

COMPUTED BY P. BROSIG.

EQUIVALENT FOCUS (INCHES).	HEIGHTS OF IMAGES (INCHES).																	
	1	2	3	4	6	8	10	12	14	16	20	24	28	32	40	48	56	68
2	138·0 2·0	70·0 2·1	47·3 2·1	36·0 2·1														
3	207·0 3·0	105·0 3·1	71·0 3·1	54·0 3·2	37·0 3·3													
4	276·0 4·1	140·0 4·1	94·7 4·2	72·0 4·2	49·3 4·4	38·0 4·5					*Values are omitted in this space on account of the wide angle of lens required. (More than ninety degrees.)*							
5	345·0 5·1	175·0 5·1	118·3 5·2	90·0 5·3	61·7 5·4	47·5 5·6	39·0 5·7											
6	414·0 6·1	210·0 6·2	142·0 6·3	108·0 6·4	74·0 6·5	57·0 6·7	46·8 6·9	40·0 7·1	35·1 7·2									
7	483·0 7·0	245·0 7·1	165·7 7·3	126·0 7·4	86·3 7·6	66·5 7·8	54·6 8·0	46·7 8·2	41·0 8·4	36·7 8·6								
8	552·0 8·1	280·0 8·2	189·3 8·4	144·0 8·5	98·7 8·7	76·0 8·9	62·4 9·2	53·3 9·4	46·9 9·6	42·0 9·9	35·2 10·4							
9	621·0 9·1	315·0 9·3	213·0 9·4	162·0 9·5	111·0 9·8	85·5 10·1	70·2 10·3	60·0 10·6	52·7 10·9	47·2 11·1	39·6 11·6							
10	690·0 10·1	350·0 10·3	236·7 10·4	180·0 10·6	123·3 10·9	95·0 11·2	78·0 11·5	66·7 11·8	58·6 12·1	52·5 12·4	44·0 12·9	38·3 13·5	34·3 14·1					
11	759·0 11·2	385·0 11·3	260·3 11·5	198·0 11·6	135·7 12·0	104·5 12·3	85·8 12·6	73·3 12·9	64·4 13·3	57·7 13·6	48·4 14·2	42·2 14·9	37·7 15·5	34·4 16·2				
12	828·0 12·2	420·0 12·4	284·0 12·5	216·0 12·7	148·0 13·1	114·0 13·4	93·6 13·8	80·0 14·1	70·3 14·5	63·0 14·8	52·8 15·5	46·0 16·2	41·1 16·9	37·5 17·6				
13	897·0 13·2	455·0 13·4	307·7 13·6	234·0 13·8	160·3 14·1	123·5 14·5	101·4 14·9	86·7 15·3	76·1 15·7	68·2 16·1	57·2 16·8	49·8 17·6	44·6 18·4	40·6 19·1	35·1 20·6			

14	996·0 14·2	490·0 14·4	331·3 14·6	252·0 15·7	172·7 14·8	133·0 15·6	109·2 16·1	93·3 16·5	82·0 16·9	73·5 17·3	61·6 18·0	53·7 18·9	19·8	43·7 20·6	37·8 22·2			
16	1104 16·2	560·0 16·5	378·7 16·7	288·0 16·9	197·3 17·4	152·0 17·9	124·8 18·4	106·7 18·8	93·7 19·3	84·0 19·8	70·4 20·7	61·3 21·6	54·9 22·6	50·0 23·5	43·2 25·4	38·7 27·3	35·4 29·2	
18	1242 18·3	630·0 18·5	426·0 18·8	324·0 19·1	222·0 19·6	171·0 20·1	140·4 20·6	120·0 21·2	105·4 21·7	94·5 22·2	79·2 23·3	69·0 24·4	61·7 25·4	56·2 26·5	48·6 28·6	43·5 30·7	39·9 32·8	36·0 36·0
20	1380 20·3	700·0 20·6	473·3 20·9	360·0 21·2	246·7 21·8	199·0 22·4	156·0 22·9	133·3 23·5	117·1 24·1	105·0 24·7	88·0 25·9	76·7 27·1	68·6 28·2	62·5 29·4	54·0 31·8	48·3 34·1	44·3 36·5	40·0 40·0
22	1518 22·3	770·0 22·6	520·7 23·0	396·0 23·3	271·3 23·9	209·0 24·6	171·6 25·2	146·7 25·9	128·9 26·5	115·5 27·2	96·8 28·5	84·3 29·8	75·4 31·1	68·7 32·4	59·4 35·9	53·2 37·6	48·7 40·1	44·0 44·0
24	1656 24·4	840·0 24·7	568·0 25·1	432·0 25·4	296·0 26·1	228·0 26·8	187·2 27·5	160·0 28·2	140·6 28·9	126·0 29·6	105·6 31·1	92·0 32·5	82·3 33·9	75·0 35·3	64·8 38·1	58·0 40·9	53·1 43·8	48·0 48·0
26	1794 26·4	910·0 26·8	615·3 27·1	468·0 27·5	320·6 28·3	247·0 29·0	202·8 29·8	173·3 30·6	152·3 31·3	136·5 32·1	114·4 33·6	99·7 35·2	89·1 36·7	81·2 38·2	70·2 41·3	62.8 44·4	57·6 47·4	52·0 52·0
28	1932 28·4	980·0 28·8	662·7 29·2	504·0 29·6	345·3 30·5	266·0 31·3	218·4 32·1	186·7 32·9	164·0 33·8	147·0 34·6	123·2 36·2	107·3 37·9	96·0 39·5	87·5 41·2	75·6 44·5	67·7 47·8	62·0 51·1	56·0 56·0
32	2208 32·5	1120 32·9	757·3 33·4	576·0 33·9	394·7 34·8	304·0 35·8	249·6 36·7	213·3 37·6	187·4 38·6	168·0 39·5	140·8 41·4	122·7 43·3	109·7 45·2	100·0 47·1	86·4 50·8	77·3 54·6	70·9 58·4	64·0 64·0
36	2484 36·5	1260 37·1	852·0 37·6	648·0 38·1	444·0 39·2	342·0 40·2	280·8 41·3	240·0 42·4	210·9 43·4	189·0 44·5	158·4 46·5	138·0 48·7	123·4 50·8	112·5 52·9	97·2 57·2	87·0 61·4	79·7 65·6	72·0 72·0
44	3036 44·6	1540 45·3	1041 45·9	792·0 46·7	542·7 47·9	418·0 49·2	343·2 50·5	293·3 51·8	257·7 53·1	231·0 54·3	193·6 56·9	168·7 59·6	150·9 62·1	137·5 64·7	118·8 69·9	106·3 75·1	97·4 80·2	88·0 88·0
52	3588 52·8	1820 53·5	1231 54·3	936·0 55·1	641·3 56·6	494·0 58·1	405·6 59·6	346·7 61·2	304·6 62·7	273·0 64·2	228·8 67·3	199·3 70·4	178·3 73·4	162·5 76·5	140·41 82·6	125·7 88·7	115·1 94·8	104·0 104·0

This table gives, in inches, the distances from lens to object (greater conjugate focus, upper number) and from lens to ground glass (lesser conjugate focus, lower number) for different heights of images and different lengths of foci of lenses, when the height of object is 68 inches (=average height of man).

EXAMPLES.

Q.—What is the height of image of a person who is 133 inches distant from lens, when a lens of 14 inches focus is used?

A.—The height of image in this case is 8 inches.

Q.—What are the distances between object, lens, and ground glass if the image of a person is to be 8 inches high and a 14 inches focus lens is employed?

A.—The distance from object to lens will be 133 inches, from lens to ground glass 15·6 inches.

TABLES OF DISTANCES AT AND BEYOND WHICH ALL OBJECTS ARE IN FOCUS WHEN SHARP FOCUS IS SECURED ON INFINITY.

Focal length of Lens in inches.	Ratios marked on Stops.													
	f/4	*f* 5·6	*f*/6	*f*/7	*f*/8	*f*/10	*f*/11	*f*/15	*f*/16	*f*/20	*f*/22	*f*/32	*f*/44	*f*/64
	Number of feet after which all is in focus.													
4	33	24	22	19	17	13	12	9	8	7	6	4	3	2
4¼	38	27	25	21	19	15	14	10	10	7	7	5	3½	2½
4½	42	30	28	24	21	17	15	11	11	8½	7½	5½	4	3
4¾	47	34	31	27	24	19	17	12	12	9½	8½	6	5	3
5	52	36	35	30	26	21	19	14	13	10½	9½	6½	5½	3½
5¼	57	40	38	33	28	23	21	15	14	11½	10½	7	5½	3½
5½	63	45	43	36	31	25	23	17	15	12½	11½	7½	6	4
5¾	68	50	46	38	34	27	25	18	17	13½	13	8½	6½	4
6	75	54	50	42	38	30	28	20	19	15	14	9	7	4½
6¼	81	58	54	46	40	32	29	22	20	16	15	10	7½	5
6½	87	62	58	50	44	35	32	23	22	17½	16	11	8	5½
6¾	94	67	63	54	47	38	34	25	24	19	17	12	8½	6
7	101	72	68	58	51	40	37	27	25	20	18	12½	9	6
7¼	109	78	73	62	54	44	39	29	27	22	20	13½	10	6½
7½	117	83	78	64	58	47	42	31	29	24	21	14½	10½	7
7¾	124	90	83	71	62	50	45	33	31	25	22	15½	11	7½
8	132	96	88	76	68	52	48	36	32	28	24	16	12	8
8¼	141	100	94	80	71	56	51	37	35	29	25	17½	12½	8½
8½	150	104	100	84	76	60	56	40	38	30	27	19	13½	9
8¾	156	111	104	89	78	63	57	42	39	32	29	20	14	10
9	168	120	112	96	84	67	61	45	42	34	31	21	15	10½
9¼	180	127	116	101	90	71	65	47	45	35	32	22	16	11
9½	190	133	125	107	95	75	68	50	47	37	34	24	17	12
9¾	197	141	131	113	99	79	72	52	50	39	36	25	18	12½
10	208	148	140	120	104	83	75	55	52	42	38	26	19	13

If sharp focus is secured on any of the distances shown, then with the stop indicated, all objects are in focus from half the distance focussed on up to infinity.

INDEX.

INDEX TO ADVERTISERS, PAGE 1231.

"Etc." following the number of an entry, is inserted to indicate that other formulæ will be found in the "Makers'" section.

A

PAGE

Absorption, visual and chemical .. 741
Acetone, developer 753
,, sensitiser (carbon) 799
Adhesives 993
Adurol developer 950
,, for gaslight papers 1033, 1041
Affiliation of Photographic Societies 598
Agfa formulæ 1060
Albumen paper 980
Alizarine blue sensitiser 742
Alkalies in developer 757
Alpine photography 722
Alum baths 965
Aluminium, blackening 993
American Federation of Photographic Societies 604
Amidol acid and alkaline developers 749
,, developer 951
,, for bromides .. .. 946, etc.
,, to keep.. 651
Ammonia solutions (Table of densities) 1108
Angles of view (Table) 1125
Aperture, measuring effective .. 712
Arc lamps, enclosed 716
,, ,, for printing 771
Atomic weights (Table) 1094
Artificial light 716
Artistic Copyright Society 596
Artistic lenses 705
Assistants' wages 691
Astronomical photography, plates for 718
Austin Edwards' formulæ 1000
Autotype three-colour tissues .. 633

B

Backgrounds, hanging 698
,, making 696
,, natural, in studio negatives 700
Backing plates 734, 996
Backing ortho plates 658
Balls, fancy dress 721
Barnet formulæ 1006
Bathing plates.. 654
Bayer Co.'s formulæ 1001
Bellows, circular 684
Belitski's reducer 969
Bichromate bleaching solution .. 988
,, intensifier 967
,, reducer 970
,, stains 991
Bichromated gelatine.. 799
Birds, sea, photographing 726
Bisulphite in developer 756
Blacking wood 997
Blinds, studio 701
Blue prints 992
Books on photography 1071
Boric acid in fixing bath 758
Brands of plates fewer 683
Brass, varnishing 938
,, blackening 998
Brilliancy of images 703
Bromide papers 986
Bromide, print-out emulsion .. 790
Bromides acid developer 789
,, blue tones .. 794, 796, 989
,, bright from flat negatives 1065
,, chemical retouching .. 792
,, clearing 1055
,, copper toning, 791, 797, 988, 1004
,, gold toning 989
,, green tones 795, 989
,, invisible 792
,, platinum toning 989
,, reducing 1065
,, sulphide toning, 793, 798, 988, 1004, 1031, 1059, 1065
,, uranium tones .. 793, 795, 989
,, vanadium tones .. 795, 989
,, warm-tone developer .. 791
Bubbles in lenses 702
Bühler's carbon process 800
,, toning bath for P.O.P. .. 982
Burnishing prints 995

C

	PAGE
Cadett and Neall's formulæ	1001
Camera, suggestion hand-	713
Carbon acetone sensitiser	799
„ Bühler's process	800
„ celluloid, prints on	657
„ double transfer, three-colour	633
„ formulæ	990
„ multiple printing	800
„ pigmented silver bromide	800
„ process	799
„ Selle three-colour process	641
„ three-colour films	629
Carbon-tetrachloride varnish	762
Carbonates, double in developers	753
Caseine paper	775
Catatype gumprints	816
„ printing processes	814
Celluloid, carbon prints on	657
Chemicals (Solubility tables)	1102
„ (Formulæ tables)	1096
Chromate of silver prints	816
Chromium intensifier	967
„ salts in developers	757
Cinematograph films, copyright	691
Cinematography	827
Circular bellows	684
Clearing solutions	965
Cloud photographs	723
Clouding portrait negatives	763
Coins as weights	1088
„ photographing	727
Collodion emulsion	978
„ „ safe-light	693
„ paper emulsion	985
„ prints, glazing	1054
„ „ platinum toning, 787, 1029, 1033, 1034, 1041, 1053, 1058, 1070	
„ „ stains	786
„ „ toning	786, 985
„ transfers	977
„ wet for ferrotypes	966
„ „ „ half-tone	977
„ „ „ negatives	975
Colour effects from ordinary negatives	854
„ gradation in three-	836
Colour photography, apparatus	832
„ „ basis of three colour	831
„ „ bleach-out process 648, 829	
„ „ Brasseur patents 843, 845, 852	
„ „ cameras for	833
„ „ coloured illuminants	840
„ „ carbon three-colour	841
„ „ diffraction process	845
„ „ Drac process	836
Colour Photography, filters and colours, testing	844
„ „ Lascelles-Davidson process	851
„ „ Lippmann process	828
„ „ one-plate processes	849
„ „ paper processes	843
(See also "Three Colour Photographic Printing Processes," p. 628)	
Colour Photography, pigments for	843
„ „ pinatype	845
„ „ transparencies	842
„ „ plates for	836
„ „ Powrie process	849
„ „ red filter	837
„ „ "Solgram" process	845
„ „ Sanger-Shepherd process	840
„ „ stable aniline dyes	844
„ „ starch grain process	849
„ „ transparencies	840
„ „ without filters	836
Colouring miniatures	824
„ postcards	824
„ prints	995
Coloured objects, photographing	730
Colour-sensitive plates, exposing wet	658
Colour sensitiveness of plates	738
„ „ „ (Table)	1115
Colours in spectrum (Table)	1111
Combination printing	769
Combined baths for P.O.P. 776, 984, etc.	
Combined development and fixing	963
Continental plates, sizes of (Table)	1093
Contraction of paper prints	719
Convention, the Photographic	594
"Cooke" lenses, new	703, 705
Copper toning	794, 797, 988, 1004
Copyright Act (1862)	1074
„ alterations in	689
„ Crooke-Irving case	690
„ in cinematograph films	691
„ in sculpture	691
„ valuable consideration	689
Copyright Society, The Artistic	596
Copyright Union, The	595
Corpses, photographing	722
Cost of manufacturing in the studio	691
„ negative processes	734
Criminal photography	727
Cristoid films, enlarging	822
Crystoleum colouring	823

D

Daguerreotypes, restoring	767
Dark-room light, reflected	652

PAGE

Dark-room safelights 693, 975
„ slide shutters 714
„ slides, emanations from .. 714
Dead, photographing the 722
Depth of focus 707
„ „ (Table) 1130
Developer 749, 950
„ formalin in 658, 955
„ general formula 963
„ new 749
„ acetone in 756
„ alkalies in 757
„ chromium salts in 757
„ one-tablet 757
Developing sheets 757
Development, combined 933
„ dynamics of 739
„ gelatine tanning in .. 758
„ reflected light for .. 652
„ self- 754
„ stand 754, 961
„ „ dry 687
„ time 753, 962
Dextrine paste 994
Diaphragms, standards 1093
„ Continental 1127
Dicy nine sensitiser 748, 974
Diffraction, Ives colour process .. 845
„ grating replicas .. 833
Dianol developer for bromide papers 1037
Diogen developer 952
Double carbonates in developers .. 753
Double-effect prints 817
Dusting-on process 996
„ „ three-colour 645

E

Eder's reducer 939
Edinol developer .. .. 952, etc.
Edwards' B. J. formulæ 1004
Eikonogen developer 952, 1005
Eikonogen-hydroquinone developer 953
Elements, lines of, in spectrum .. 1112
„ atomic weights of .. 1094
Elliott's formulæ 1006
Emulsion, bromide print-out .. 790
„ collodion 978
„ caseine 775
„ films drying 785
„ „ microscopy of .. 739
„ phosphate 774
„ P.O.P. 981, 985
„ pyridine 734
„ silicic acid 735
Enamels 870
Encaustic paste 995
Enclosed arc lamps 716, 771
Engines, photographs of 727
Enlargements, direct on gum paper 806
„ painting 823
„ Solar 821
„ (Table) 1122

PAGE

Enlarging, exposures in 819
„ „ „ daylight .. 820
„ films by expansion .. 822
„ local development .. 820
Equations relating to foci (Table) .. 1120
Ethyl-red sensitiser 974
Events of the year 688
Expansion of paper and gumprints 807
Exposure tables 1116
Exposures in copying and enlarging (Table) 1123
Eye-piece, focussing 650
Eyes, photographing 722

F

Factorial development .. 753, 962
Farmer's reducer 969
Ferro-gallic paper 993
„ prussiate 992
Ferrotype positives, collodion .. 977
Ferrous citrate developer 1038
„ oxalate „ .. 953, etc.
„ „ for bromides .. 937
„ „ H. & D. 954
Figures in negatives, introducing .. 770
Film negatives, enlarging 822
„ „ machine printing .. 771
„ „ stripping 972
„ varnishes 971
"Filter yellow K." 746
Filters and inks, tests of 841
Firelight effects 721
Fixation, theory of 740
Fishes, photographs of 726
Fixative for crayon 995
„ for pastel work 825
Fixing bath, alum 759
„ „ boric acid in 758
„ baths .. .. .. 963, etc.
„ „ acid 964
Flash powders 659
Focal length finding 713
Foci, equations relating to (Table) . 1120
Focus, depth of 707
„ distances (Table) 1130
Focussing eye-piece 650
„ line drawings 728
„ scales by graphic methods 709
„ screens, line 713
Fog, marginal 741
Fogged plates, recovering 996
Formate, P.O.P. toning bath .. 1066
Four-colour processes 852
Framing, airtight 819
Freezing mixtures 1116
Friction marks on gaslight prints .. 793

G

Gaslight papers 793, 986
„ warm tones 792, 1033, 1041, 1051
Gelatine, bichromated 799

PAGE

Gelatine, mountant 993
„ tanning in developer .. 758
Gelatine P.O.P. (see P.O.P. gelatine, 773 and 981)
Gem formulæ 1009
Glass, optical, browned 703
Glazing collodion prints 1034
Glycin developer .. 954, 979, etc.
Grain emulsion fine 735
„ in emulsion 738
Griffin's formulæ 1010
Ground-glass varnish 972
Gum-bichromate 805
„ „ catatype 816
„ „ multiple 807
„ „ three-colour .. 643

H

Half-tone wet collodion 975
Hand-camera suggestion 713
H. and D. standard iron developer 954
„ „ pyro „ .. 960
Hardening baths 965
History 962
Homocol sensitizer 974
Hot weather developer 658
Hydrogen peroxide prints 814
Hydroquinone developer .. 954, etc.
Hypo-alum toning 988, 1031
„ „ cold 793
„ eliminators 964

I

Ilford formulæ 1014
Illingworth formulæ 1020
Imogene-sulphite developer 956
Imperial formulæ 1022
Infinity for various lenses (Table) 1121
Ink for lantern-slides 997
„ for rubber stamp 997
„ invisible 997
Insects, photographing 686
Instantaneous exposures (Table) .. 1118
Insurance rules and animated photography 1082
Intensifier, acid silver 967
„ chromium 967
„ for collodion 979
„ copper 968
„ lead 968
„ mercury 966
„ „ sulphide .. 760
„ Monckhoven's 966
„ permanganate 760
„ re-developer 970
„ silver 967
„ sulphide 761
„ uranium 968

PAGE

Intensifying reduced negatives .. 761
Invisible bromides 792
„ ink 997
Iron citrates 813
„ developer 953
„ citrate developer 1038
„ printing processes .. 812, 992
Isocol sensitiser 748, 974

J

Judicial photography 729

K

Kachin developer .. .. 955, etc.
Kallitype paper 992
„ water-developing 812
Kodak formulæ 1025

L

Lancashire and Cheshire Photographic Union 603
Lantern projection in daylight .. 826
„ „ (Table) 1126
Lantern-slide developers, 1000, 1002, 1006, 1010, 1013, 1038, 1045, 1049, 1051, 1061, 1063, 1069
„ „ drying 826
„ „ ink 997
„ „ masking 825
„ „ two-colour toning .. 825
„ „ varnishing 826
Lead intensifier 968
Leto formulæ 1032
Light-filter, exposure with 666
Line drawings, focussing 728
„ „ from bromides .. 990
Linked Ring, The 598
Lippmann process 828
Lumière colour processes 641
„ formulæ 1035
„ intensifier 966
Luminosity filter 748

M

Machine printing from film negatives 771
Machinery, photographing 937
Magnesium light 718
Manganese prints (catatype) .. 815
Marion's formulæ 1037
Mattos formulæ 1043
Mawson and Swan's formulæ .. 1044
Medals, photographing 727

PAGE

Mercury, bromide toners 798
„ cyanide reducer 969
„ intensifiers 963
Metal, mounting on 994
„ prints on 817
Metol developer .. .. 956, etc.
„ „ for bromide 986, etc.
„ skin affection 750
Metol-hydroquinone developer 957, etc.
„ „ developer for bromide .. .. .. 987, etc.
Metric measures 1085
Midget photography 722
Miniatures, colouring 824
Mirrors, making 998
Monckhoven's intensifier 966
Moonlight photographs 724
Motion rendering 725
Mountants 993
Mounting, multiple 819
„ paper, self- 818
Moving objects (Exposure table) .. 1118
Multiple printing, registration in .. 771

N

National Photographic Record Association, The 597
Negatives, numbering 682
„ putting figures into .. 770
„ reversed 765
Negative processes, cost 734
„ varnishes 970
Night photographs, figures in .. 725
Nomenclature, optical 702
Northumberland and Durham Federation, The 604

O

Obituary 625
Oil process 803
Optical nomenclature 702
Orthochromatic formulæ 973
„ plates (Table) .. 1115
„ „ by bathing .. 654
„ „ testing .. 747
Ortol developer 957, 1057
„ „ for bromides .. 987
Oval, how to draw an 763
Ozobrome process 802
„ in three-colour 636
Ozotype formulæ 1047

P

PAGE

Pagel formulæ 1043
Painting, enlargements 823
Panchromatic plates 838
Paper expansion and gum prints .. 807
„ prints, contraction 719
Papers, raw tests of 720
Paramidophenol developer .. 958, etc.
Pastel work, fixative for 825
Patents Act 1080
Pellet paper 993
Pencil writing, photographing .. 730
Permanganate intensifier 760
Peroxide, prints with 814
Perspective of aerial image 702
Persulphate as anti-hypo 964
„ „ effect with other reducer .. 761, 762
„ reducer 969
Phosphorescent prints 817
Photolinol formulæ 1055
Photo-Secession, The 604
Pigments for three colour 843
Pinachrome sensitizer 974
Pinacyanol sensitizer .. 742, 748, 974
Pinatype colour process 636
„ modifications 682
Pinhole exposures 734
Plain-paper formulæ 979
„ Mattos 1043
Plate speeds 736
Plates, fewer brands of 683
„ sizes of, English and foreign 1093
Platinum printing 991
„ prints, blue 811
„ „ green 811
„ „ iron in 810
„ „ intensifying .. 992
„ „ "Japine" 812
„ „ reducing and clearing 653
„ „ varnishing .. 811
Poisons Act 1080
„ and antidotes (Table) .. 1132
Polishing wood 998
P.O.P. caseine 775
P.O.P. collodion (See Collodion paper)
P.O.P.—colours by toning 777
„ combined bath .. 776, 684
„ developing 780, 984
„ emulsion 981
„ „ without silver .. 773
„ glazing 779
„ paper for emulsion 773
„ phosphate emulsion 774
„ platinum toning 983, 1011, 1027, 1039
„ reducing 779, 984
„ Reichel three-colour process 645
„ self-developing 774
„ spots on prints 780
„ sulphide toning 778
„ toning 775, 984

PAGE

Portraits, softening 658
Posing chair 684
Positives direct in camera 766
„ „ double film 766
„ ferrotype 976
Postal clubs 586
Postcards, colouring 824
„ rapid printing 790
„ statistics 692
„ toning on small wholesale scale 775
Printing by arc light 771
„ combination 769
Prints in relief 818
Professional Photographers' Association, The 593
Professional Photographers' Society of New York, The 594
Projection, distances for (Table) .. 1126
Pulligny-Puyo lenses 705
Pyridine emulsion 734
Pyro acetone developer 959
„ ammonia developer .. 959, etc.
„ caustic-soda developer .. 961
„ metol developer.. .. 960, etc.
„ potash developer .. 959, etc.
„ preserving in solution .. 661
„ soda developer .. .. 960, etc.
„ „ „ H and D .. 960
„ „ „ keeping the .. 751
Pyrocatechin developer .. 958, etc.
Pyroxyline 975

R

Rajar formulæ 1055
Record, photographic 597
Red filter in three-colour work .. 839
Red-sensitive plates 743
Reduced negatives, intensifying .. 761
Reducer, Belitski's 969
„ bichromate 970
„ cobaltamine 779
„ Farmer's 969
„ iodine-cyanide 970
„ mercury-cyanide 969
„ persulphate.. 969
„ „ effect 761, 762
„ thiocarbamide 1065
Reduction, local hand 764
Registration in multiple printing .. 771
Reichel three-colour P.O.P. process 645
Relief, appearance of 818
„ prints, printing from .. 802
Rembrandt lighting 672
Replicas of diffraction gratings .. 833
Reproduction fees 1079
Retoucher's multi-rule 661
Retouching varnish 972
„ negatives 763
Reversed negatives 765
Rodinal developer .. .. 961, etc
„ „ for bromides 987, etc.
Rotary formulæ 1057
„ pigment films 629
Rouch's formulæ 1060
Royal Photographic Society .. 555
Rubber-stamp ink 997

S

Safe-lights formulæ 693, 975
Salon, the Photographic 598
Sarger Shepherd imbibition colour process 636
Scheduled poisons 1080
Scottish Photographic Federation, The 601
Self-developing plates 754
Self-toning papers 785
„ Poulsen emulsion .. 785
„ prints, reducing.. .. 665
Selle carbon three-colour process .. 641
Sensitisers, collodion emulsion .. 974
„ gelatine plates 654
„ orthochromatic .. 742, 973
„ panchromatic 974
Sepia paper 992
Sheets, developing 757
Shellac mountant 954
Shutter speeds, testing .. 667, 715
Shutters, focal-plane 715
Silicic acid emulsions 735
Silk, prints on 817
Silver haloids (Solubility table) .. 1108
„ intensification 965
„ stains, removing 965
Silvering mirrors 998
Sink for P.O.P. washing 779
Snowstorm photographs 724
Societies, British 556
„ Colonial 588
„ summer programme .. 692
Softening definition.. 658
Solar prints 816, 821
Solgram colour prints 845
Solubilities table 1102
Solubility of silver haloids 1109
Spectro-sensitometry 749
Spectroscope, use of 832
Spectrum, bright lines in (Table) .. 1112
„ colours in „ .. 1111
Speeds, &c., of plates (Table) .. 736
„ shutter testing .. 667, 715
Splatter work 763
Spotting prints.. 996
Stage scenes, photographing .. 725
Stain removers.. 965
Stand development 754, 961
„ „ dry 687
Starch paste 994
Stationery, photographers' 692
Stereoscope, simplest form 659

PAGE

Stereoscopic photography 730
„ projection 733
„ separation 653
Stereoscopy, palmy days of 656
„ plates for hand-camera 681
Stereo-telephot 732
Stops, blackening 998
„ Continental (Table) 1127
„ R.P.S. standard 1093
Storing negatives 682
Stripping negatives 972
Studio blinds 701
„ distances (Table) 1128
„ reflected light 695
Sulphide toning bromides, 793, 798, 988, 1004, 1031
„ „ P.O.P. 778
Sulphide-toning, chemistry of .. 676
Sulphite, deterioration of 751
Sunbeams, photographing 726
Survey associations 597

T

Tartrazine filters for dark-room .. 693
Telephoto lenses, Zeiss 711
„ portraiture 721
Tele-photography at home 662
Theatrical photography 725
Thermometric tables 1110
Thiocarbamide clearing bath .. 1065
„ toning bath 982
Thomas's formulæ 1061
Three-colour photographic printing processes 628
Time development 753, 962
Titles on negatives 765
Toning, hot chemical 777
„ postcards on small wholesale scale 775
Tracings, copying 813
Traill-Taylor lecture 689
Two-colour processes 852
Tylol developers 752

U

Ultra-violet absorption by glass .. 703
Underground photography 727
Uranium intensifiers 968
„ toning (bromides) 793, 795, 989
„ „ (P.O.P.) 984
Uviol glass 703

V

PAGE

Vanadium tones 795, 989
Varnish, carbon tetrachloride .. 762
„ cold 971
„ film 971
„ ground-glass 972
„ negative 970
„ retouching 972
„ water 971
„ for brass 998
„ lantern slide 826
View angles (Table) 1125
Vignetting 768

W

Wages, assistants' 691
Washing of plates, rapid 759
„ prints, sink for 779
Waterproofing wood 997
Watkins factors 962
Weights and measures (Tables) .. 1084
Wellington intensifier 967
„ and Ward's formulæ .. 1062
Wet collodion (*See* Collodion, wet) 975
White ink 997
Wood, dead-black for 997
„ polishing 998
Working up and colouring 823
Wratten formulæ 1068
Writing and printing, photographing 728

Y

Yorkshire Union, The 602

Z

Zimmermann, Chas. & Co.'s formulæ 1069



CONTRIBUTORS.

	PAGE		PAGE
Baldock, J. H.	662	Newton, A. J.	654
Ballance, G. R.	653	P., W. E.	661
Bolas, T.	650	Payne, Arthur	666
Brigham, W. Foster	684	Perkins, Rev. T.	665
Carnegie, Douglas	676	Piper, C. Welborne	651
Duncan, F. Martin	683	Pontifex, H. G.	667
Foxlee, E. W.	657	"Practicus"	672
Grills, E.	682	Rohr, Dr. Moritz von	656
Hackett, J. T.	672	Selb, Victor	663
Harris, G. T.	652	Smith, C. Grant	687
Henderson, A. L.	659	Smith, Joseph	682
Hett, Charles Louis	681	Valentine, G. W.	684
Lockett, A.	659	Watkins, Alfred	683
Mills, Edmund J.	658	Whiting, Arthur	661

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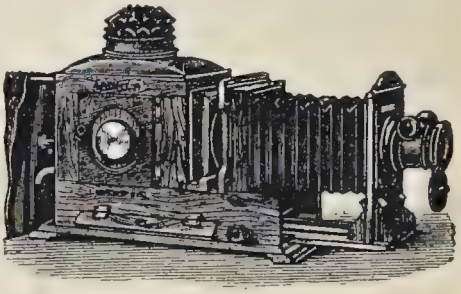
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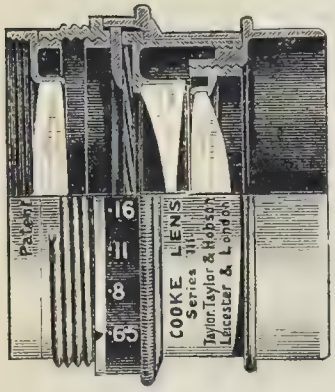
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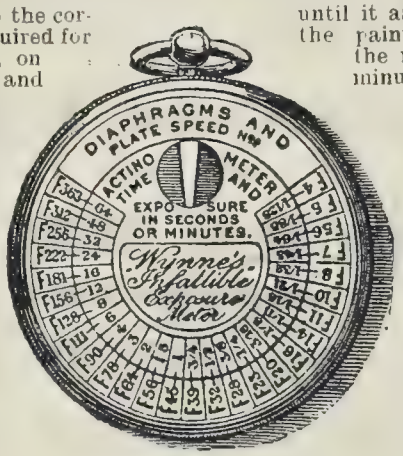
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until it assumes the colour of the painted tint, and note the number of seconds or minutes it takes to colour. This is called the ACTINOMETER TIME

SECONDLY.—Set the movable scale until this ACTINOMETER TIME is against the F SPEED NUMBER OF THE PLATE to be used (see Plate Speed List below), then against every stop in outer scale will be found the correct corresponding exposure, or, shortly, *you set the one Scale it does the rest.*

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Ilford Empress	,, *f*/45	Wratten Ordinary ...	,, *f*/23
Imperial Special Rapid	,, *f*/78	Warwick Double Inst. ...	,, *f*/90

The following examples illustrate the extreme simplicity of the Exposure Meter:

No. of Example	A Assumed Actinometer Time.	P Plate to be used. See List of Plate Speeds above.	S Stop to be Employed	E Correct Exposure for the three foregoing conditions.
No. 1	8 sec.	Paget XXX ... Speed *f*/56	*f*/32	3 sec.
,, 2	3 sec.	Lumière Ex. Rapid ,, *f*/78	*f*/5½	$\frac{1}{64}$ sec.
,, 3	6 min.	Eastman Film ... ,, *f*/78	*f*/16	$\frac{1}{4}$ min.
,, 4	48 sec.	Warwick Double Inst. ,, *f*/90	*f*/8	$\frac{8}{8}$ sec.
,, 5	32 min.	Wratten Ordinary ,, *f*/23	*f*/28	48 min.
,, 6	16 sec.	Mawson Electric ... ,, *f*/64	*f*/7	$\frac{1}{2}$ sec.

To find the correct exposure in each of these examples, set Actinometer Time in column A against Plate Speed Number in column P, then against the stop to be employed in column S will be found the correct exposure in column E, and in each case the correct exposure will also be simultaneously shown against every other stop on the outer scale.

[*See following pages.*

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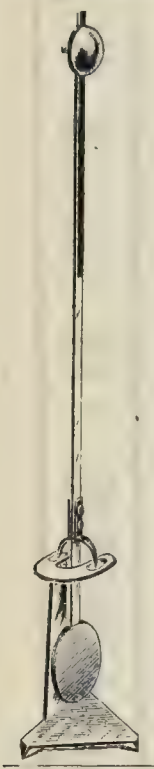
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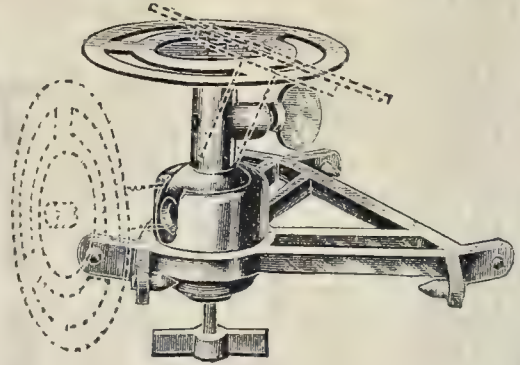
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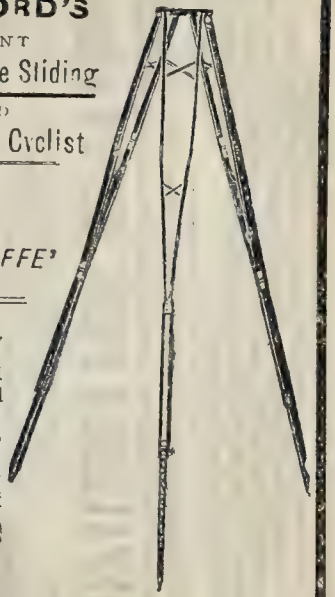
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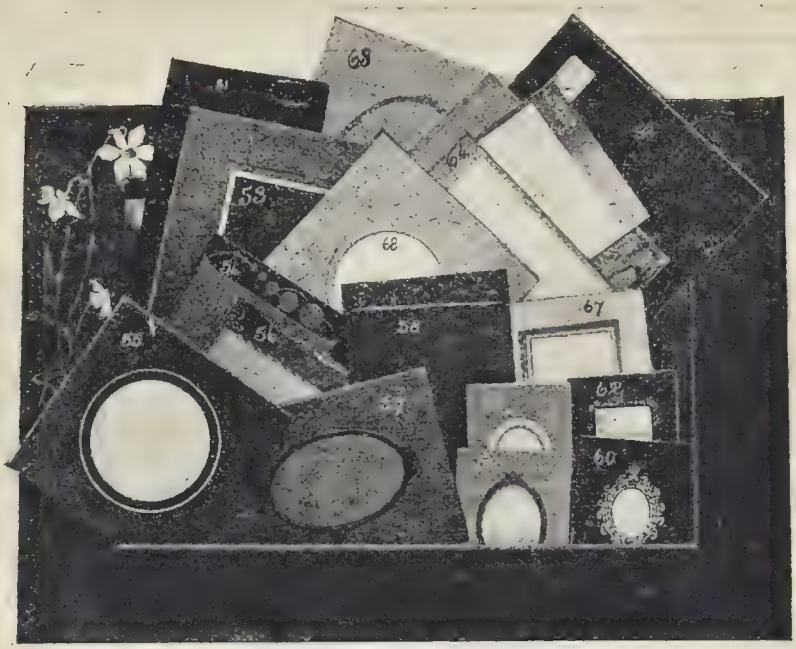
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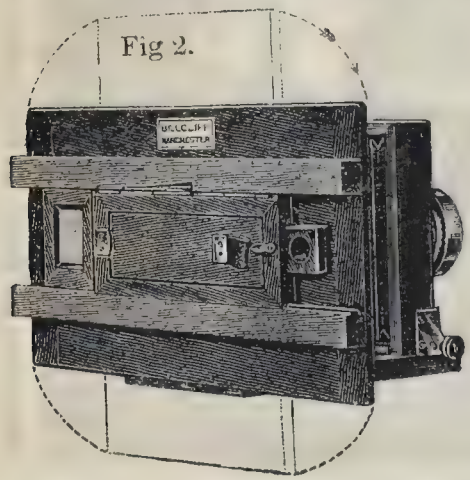


Fig 2.



Fig. 3

Camera with Bellows, Rack and Pinion focussing, Rotating Back for Upright or Group Pictures and fitted with No. 4 Repeating Back, for 6 Stamp Photos (size $1\frac{3}{8} \times 1$in.) on $\frac{1}{3}$ of $\frac{1}{2}$ plate as Fig. 2	2	12	6
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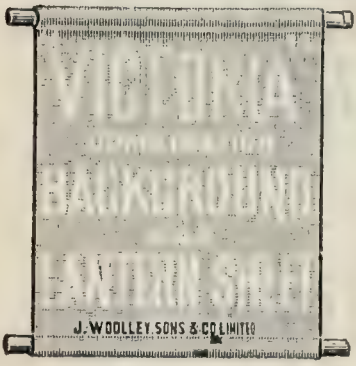
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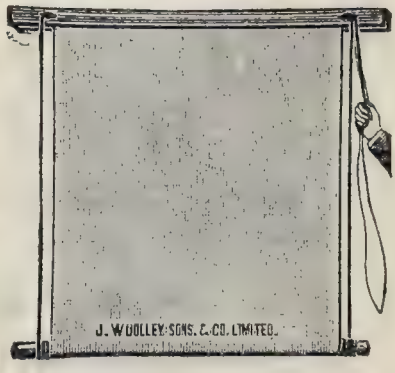
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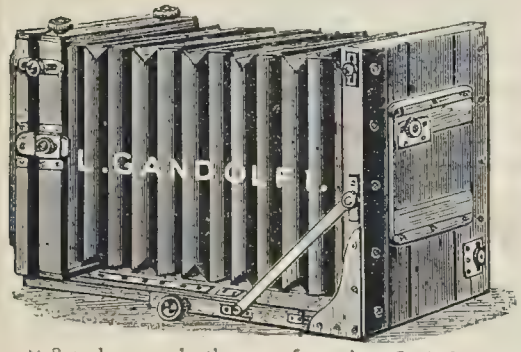
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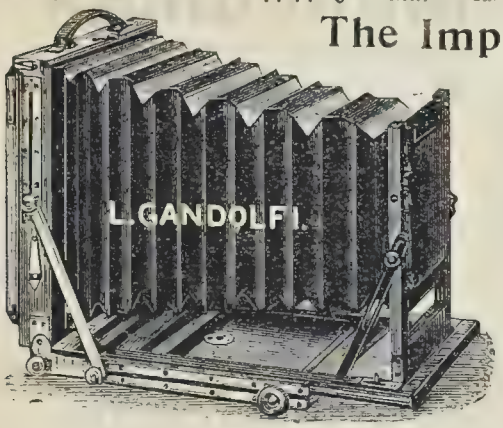


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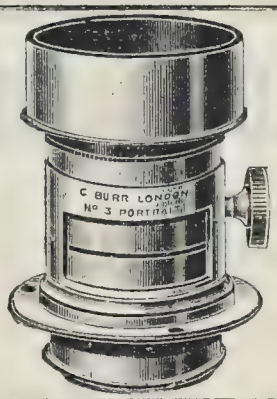
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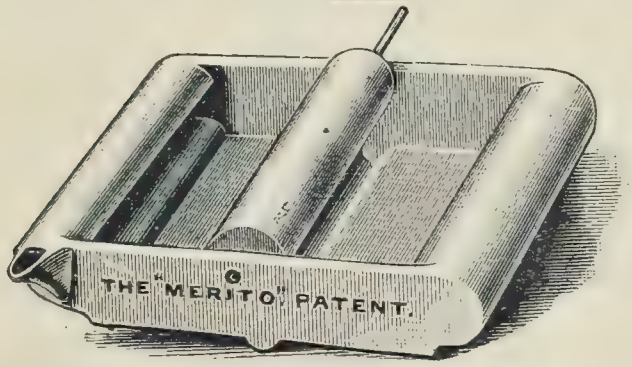
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PATENT NON-SPLASHING PLATE AND FILM DISH.



PRICES :—
¼-plate, **1/6** complete.
½-plate, **3/-** ,,

No other Dish possesses so many unique features.

Note improved Rocking Bar.

☞ Made in a specially-prepared substance termed "Adamant Porcelain," which is very strong and almost non-absorbent. For film development a Roller is supplied with a rod passing through the circular holes in the sides of the dish. This is withdrawn when used for plates.

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